

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

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I.—FOOD AND FODDER PLANTS.

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The question of food, though always before us, has recently commanded more than ordinary interest because of the failure or uncertainty of many of the sources on which we have been accustomed to rely. It may be scarcely necessary to state that the subject is here treated in the sense that plants yield food for human beings and fodder for animals. The Natural Families first in importance for plants of this nature are *Leguminosae*, *Gramineae*, *Cruciferae* and *Rosaceae*, the "Pulses," "Cereals," "Vegetables," and "Fruits" predominating in each Family respectively. These will be considered first, and the remaining Families that come under review are selected as containing important products, as for instance, *Solanaceae* for potatoes and tomatoes, *Chenopodiaceae* for sugar beet and mangels, *Scitamineae* for the banana, *Palmae* for the coco-nut, &c. The plants of greater importance are given with the botanical name first, followed by the common names, the chief countries of production, brief details as to uses and other notes of interest; others of lesser value or so well known as to need no description are enumerated at the end of their Family with the position of scientific and common names reversed. The imports into this country are given in brackets immediately after the country of production, all figures being reduced to the nearest approximate number of cents and unless otherwise stated they refer to the year 1913, quoted from the "Annual Statement of the Trade of the United Kingdom," Vol. i. 1917. The approximate production of some of the principal crops in the United Kingdom is given in figures of the same denomination. Values are not stated as they are subject to fluctuation, and current prices are readily obtainable when required from the various official publications and trade journals. No attempt is made to include details of culture nor of diseases, as these subjects could not be properly dealt with in the space available; moreover, there are many valuable publications which treat with these matters; nor are the important issues of "vitamines" and "calories" taken into consideration. Full references to works quoted (under author's

names) as authority for certain statements are given at the end of a Family or at the end of the complete paper. The references applying to individual plants are confined to the Kew Bulletin and to publications of the Board of Agriculture, referred to as 1. (*Kew Bulletin*) 1a. (*Kew Bulletin*, Additional Series), 2. (*Journal of the Board of Agriculture*), 3. (*Leaflets*), 3a. (*Special Leaflets*).

Included in the paper are plants that have been the subject of enquiries at Kew, from time to time, in the search for new introductions or those capable of further development.

LEGUMINOSAE.

Lupinus albus, *Linn.*; White Lupin. **L. angustifolius**, *Linn.*; Blue Lupin. **L. luteus**, *Linn.*; Yellow Lupin and **L. termis**, *Forsk.*; Egyptian Lupin.

Annual plants of vigorous growth. Central and Southern Europe, Egypt, United States, Great Britain, though not of first importance in the two last-mentioned countries.

Seeds* used as food and fodder on the Continent and in Egypt. "Lupins are used to some extent for sheep in Norfolk and Suffolk, but they need to be fed very carefully and should only be given in quite small quantity at first" (Voelcker, *Journ. Roy. Agric. Soc. England*, lxx. 1909, p. 347); "their use for horses, cattle or pigs is not recommended and it would appear that on the whole the best use that lupins can be put to is to cut them green as fodder" (*idem*, l.c. xxiii. 1887, p. 306). "Utilized as pasturage, green feed or hay for sheep and goats; other animals will not eat them on account of the bitter taste," but "the hay, after soaking in cold water, is eaten by cows and horses" (Piper). The uncertainty in the use of lupins is due to a bitter principle contained chiefly in the seeds and to a lesser extent in other parts of the plant. Disembittering is recommended before feeding, and this may be effected by "soaking the seed in water for four hours with frequent changes of water, steaming for one hour and then extracting for two days with frequent stirring; in the latter operation the discoloured water is drawn off frequently and fresh water added." "Five pounds daily of this disembittered lupin seed may be fed to cows per 1000 lb. live weight" (U.S. Dept. of Agric. *Farmers' Bull.* No. 16, 1894, p. 12).

Ulex europaeus, *Linn.*; Gorse, Furze, Whin.

An evergreen shrub, about 6 ft. high when fully grown; "Foxtail" is an almost spineless variety, in favour as being easier than the ordinary to harvest. *Ulex nanus*, *Forst.*, which grows about 2 ft. high, has softer shoots than those of *U. europaeus*.

Native of Britain; cultivated in Ireland, Wales, North of

* It may be advisable to refer to works on Lupin poison, and amongst recent researches reference might be made to "Lupines as Poisonous Plants," by C. D. Marsh, A. B. Clawson & H. Marsh, U.S. Dept. of Agric. *Bull.* No. 405, 1916, pp. 1-44; and "Lupines (*Lupinus* spp.)" in "Plants Poisonous to Stock," by H. C. Long (1917), pp. 29-32.

France, Brittany, &c., as a forage plant, suitable for all kinds of stock. It is recommended to cut every two years. Average yields in Brittany are from 10 to 12 tons of green stuff per acre, and plantations are usually maintained for 6 to 8 years but are sometimes kept down for 15 to 20 years (Inter. Rev. Agric. Rome, vii. Oct. 1916, p. 1407).

2. Dec. 1911, "Cultivation of Furze for Fodder and for Seed in France," pp. 759-762; Nov. 1912, "Gorse, Furze or Whins as a Forage Crop," pp. 670-671; Aug. 1915, "Gorse or Furze," pp. 455-456. 3a. No. 34, 1915, "Autumn and Winter Fodder," "Gorse or Furze," pp. 3-4.

Cytisus pallidus, Poir.; Gacia blanca (La Palma). **C. palmensis**, Hutchinson; Tagasaste. **C. stenopetalus**, Christ; Gacia.

Shrubs 10 to 15 ft., native of the Canary Islands where they are cultivated as forage crops. The plants may be cut two or three times a year and 35 lb. of green branches chopped and mixed with 20 lb. of chopped straw is said to be a sufficient daily feed for a horse or cow. Seeds, especially of "Tagasaste" have been distributed from the Royal Gardens (beginning 1879) to various Colonial Governments, and very satisfactory reports of successful growth have been received from South Australia, Ootacamund (Madras), Natal, Cape Province (Union of South Africa), &c. The introduction, however, is only of importance to countries with a hot, dry climate, similar to that of the Canaries, in the Tropics or Sub-tropics, where other fodder plants are scarce and difficult to establish.

1. 1891, "Tagasaste (*Cytisus proliferus*, Linn. var.)," pp. 239-244; 1893, *Ibid.* var. *palmensis*, pp. 115-117; 1918, "Tagasaste and Gacia (*Cytisus* spp.)," pp. 21-25. 1a. ix. 2 (1912) "*Cytisus*," pp. 179-180.

Medicago lupulina, Linn.; Black Medick, Minette, Trefoil, Yellow Trefoil, Yellow Clover, Nonsuch.

Annual. Europe, Africa, India, America—thoroughly established from Ontario to the Gulf of Mexico (Piper).

A forage plant commonly grown in pastures. The seed has been used to adulterate that of "Alfalfa," and this may account for the circulation at times of the empty legumes, of which a sample was submitted to Kew for identification in 1904, said to be used as a cattle food in the north of France, under the name of "Les Casses de Minettes." Another sample was received in the course of the present year, and they have also been noted in a mixture for feeding fowls.

Medicago sativa, Linn.; Alfalfa, Lucerne, Purple Lucerne, Burgundy Trefoil, Cultivated Medick, Bersim Hedjaz (Arabic).

Perennial, 1 to 2 ft. high. Cultivated under established conditions in Europe—France (Provence especially), Spain, Mediterranean region, Great Britain—England, chiefly Essex, Kent and Suffolk (these 3 counties growing upwards of 30,000 acres out of approximately 50,000 for all England), Wales (306

acres in 1917), Scotland (6 acres in 1917), Asia, Africa—Transvaal, Cape, &c., America and Australia. There is probably no other forage crop so widely grown, including tropical, sub-tropical and temperate conditions in arid, semi-arid, and wet regions. Used chiefly as fodder for cattle, horses, sheep and pigs, either green, as hay, as pasture, as ensilage—though this is not often necessary, more particularly in dry climates—and as meal, the dried stems and leaves ground up and mixed with grain or molasses. The flowers are good for feeding bees.

There are several popular forms—Provence, Turkestan, Arabian, Peruvian (var. *polia*, Brand, in which the whole plant is pubescent, giving a field of silvery-white appearance against the vivid green of the common form). “Provence Lucerne” is, perhaps, the one most generally grown, and this is the principal source of the commercial supplies of seed.

1a. ix. 2 (1911), pp. 186-190. 2. Dec. 1896, “Cultivation of Lucerne in England,” pp. 299-300, with table of acreage in various counties; Sept. 1897, “Value of Lucerne as a Fodder Crop,” pp. 218-221; March, 1901, “Experiments with Lucerne,” pp. 485-488; Dec. 1902, “On the Cultivation of Lucerne,” pp. 343-344; July, 1905, pp. 225-227; May, 1906, “Lucerne and Trefoil Seeds,” pp. 82-91; July, 1910, “Time of Cutting Lucerne,” p. 305. 3. No. 160, 1915, “The Cultivation of Lucerne.”

The “Yellow Lucerne” (*Medicago falcata*, Linn.), is an indigenous Alfalfa of Europe and Northern and Central Asia, cut for fodder as a wild plant in certain parts; but it does not appear to be generally cultivated. “Heart Clover” or “Spotted Bur Clover” (*M. maculata*, Sibth., *M. arabica*, All.) is a useful fodder plant in the United States.

Melilotus alba, Desr.; Sweet Clover, Bokhara Clover, White or Sweet Melilot, Honey Clover, Siberian Melilot.

Biennial, about 3 ft. high. Europe, Asia, United States. Grown for pasturage, hay, soiling—but not commonly for this purpose, though “hogs eat it readily when thus fed,” and silage. The “cumarin content makes animals avoid it until they have acquired a taste for its bitterness.” (Piper). A good bee-feeding plant.

Trifolium alexandrinum, Linn.; Berseem or Bersim (Arabic).

Annual. Cultivated in Egypt and introduced to the S. United States. An important forage crop in Egypt, where it seems to suit the conditions as a cool season crop under irrigation, followed by cotton, &c., in the hot season, and is there preferred to “Alfalfa,” which is also grown. It does not, however, appear to be able to compete with “Alfalfa” elsewhere.

Trifolium hybridum, Linn.; Alsike Clover, Swedish Clover.

Perennial, 2 ft. or so in height. S. Europe, Asia Minor, Algeria; cultivated in Sweden, Great Britain, United States, Canada. Grown for temporary and permanent pasture and for hay. It makes a good substitute in ground “sick” of red

clover. Except for colour the seeds of "White Clover" are not unlike those of "Alsike," and it is stated that "when the seed of this species was very expensive, bad samples of white clover were dyed green and mixed with the genuine Alsike Clover" (Hunter). Commercial seed can now be obtained from Canada.

See Journal Notes and Bd. of Agric. Leaflet No. 184, under White Clover.

Trifolium incarnatum, Linn.; Crimson Clover, Italian Clover, Trifolium (the seed is so distinguished from that of other clovers in the Trade).

Annual, 3 ft. high; there are three forms under cultivation—early, late and medium, and also a white flowered form. Southern Europe, Great Britain—southern counties more particularly, United States. Grown for pasturage and as a soiling crop. It is considered unsuitable for hay or feeding after flowering, as the hairs of the mature heads are liable to form "hair-balls" in the intestines, and the plant, moreover, gets too woody for hay when allowed to grow to maturity.

2. Aug. 1906, "Italian or Crimson Clover," pp. 264-271.

3. No. 182, 1911, "Crimson Clover (*Trifolium incarnatum*)."

3a. No. 28, 1916, "Suggestions for the Cultivation of Catch Crops and Home-Grown Feeding Stuff," pp. 8-9.

Trifolium pratense, Linn.; Red Clover.

Perennial, a foot or so high, but usually cultivated as an annual or biennial, the land otherwise becoming "clover sick." Europe in general, including United Kingdom; Asia—Turkestan, S. Siberia, Himalaya, &c.; America, N. Africa. In America it is the most important leguminous crop, the area grown being about five times that of "Alfalfa" (Piper) and as a fodder crop, for soiling or for hay, in this country, it is of the greatest importance. The var. *perenne* is known as "Cow Grass," "Single Cut Cow Grass" or "Late Flowering Red Clover"; it stands better as a perennial and is more suitable for permanent pastures.

2. March, 1904, "Experiments in the Growth of Red Clover," pp. 499-501; March, 1906, "Red Clover and its Impurities," pp. 716-721; May, 1906, "Trials of Different Varieties of Red Clover," pp. 96-99; Nov. 1906, "A Russian Type of Red Clover," pp. 471-472.

See Bd. of Agric. Leaflet No. 184, 1913, under White Clover.

Trifolium repens, Linn.; White Clover, Dutch Clover.

Perennial, 1½ ft., Europe—Russia, Germany, Holland, Italy, United Kingdom, &c., United States, Canada, New Zealand. A fodder plant equal in importance to "Red Clover" and of greater value for pastures. "Ladino" is a variety (*latum*, McCarthy) grown in Italy, a strong grower, sometimes advertised as "Giant," "Mammoth" or "Colossal White Clover" (Piper). The seed has been found to be adulterated with that of "Clustered Clover" (*T. glomeratum*, Linn.), found in the south of England, the Mediterranean region, N. Africa, New Zealand, &c., and of *T. parviflorum*, Ehrh., native of Central and Southern Europe;

samples of both species having been grown and identified at Kew; they are both annuals of little or no value for fodder. "Suckling Clover" (*T. minus*, Relham—*T. dubium*, Sibth.), a common weed, has also been found as an adulterant, but this plant, although much inferior to White Clover—price less than half—is sometimes grown in mixed pastures. The Customs Returns of imports of clover seed are given under the heading "Seed—Clover and Grass," and the Returns as to the production in the United Kingdom are included in "Clover, Sainfoin and Grasses under Rotation"—for figures, see end of *Gramineae*.

"Uganda Clover" (*Trifolium Johnstoni*, Oliv.) grown in pastures of Kikuya (5-6000 ft.), is recommended for hill pastures in other tropical countries, and seeds were distributed in 1899 to various Colonies, (*K.B.*, 1899, p. 137). "Shaftal or Persian Clover" (*T. resupinatum*, Linn.) is cultivated for forage in Persia and North-west India.

2. April, 1906, "White and Alsike Clover Seed and their Impurities," pp. 7-15; Dec. 1909, "Trials of Wild White Clover," pp. 713-718; Feb. 1916, *ibid.*, pp. 1063-1068; July, 1911, "Sale of a Weed Seed as White Clover," pp. 323-324; June, 1915, "Adulteration of White Clover Seed," pp. 253-254; Jan. 1917, *ibid.*, pp. 940-944; March, 1917, "Ordinary White Clover Seed versus Wild White Clover Seed," pp. 1202-1208; July, 1917, "Wild White Clover (*Trifolium repens*) for Artificial Grass Land," pp. 424-428.

3. No. 184, 1913, "Red, White and Alsike Clovers."

The following papers in the Journ. Bd. Agric. have reference to the genus *Trifolium*; Sept. 1901, English and Canadian Clover Seed," pp. 206-207; Oct. 1912, "The Study of Agricultural Seeds," pp. 529-541—"Perennial Red," "Alsike" and "White" Clovers; Jan. 1916, "Purchase of Clover Seed," pp. 997-998; May, 1918, "The Shortage of Clover Seed in Essex in 1917," pp. 176-179.

***Anthyllis vulneraria*, Linn.;** Kidney Vetch, Ladies Fingers.

Perennial, about 6 in. or so in height; considerable variety is found in the colour of the flowers—red, white, yellow, &c., and various shades of these, but the forms with yellowish or reddish flowers are usually cultivated. A British plant, also found in other parts of Temperate Europe, N. Africa, &c.; cultivated, but not of special importance in America. As a fodder plant it is recommended for mixed pastures, especially in situations not good enough for "Red Clover." Sheep feed freely on this plant.

***Hedysarum coronarium*, Linn.;** Sulla, Sainfoin d'Espagne, French Honeysuckle.

Perennial, 1 to 6 ft. high. Mediterranean region—S. Europe and N. Africa; United States, where it is fairly successful in S. Texas under irrigation; but cannot compete with "Alfalfa" (Piper). The plant is adapted to cultivation in hot, dry countries as it stands drought well. As a fodder plant it compares very favourably with "Alfalfa" in feeding value. The hay has been imported into this country from Algeria and Malta.

la. ix. 2 (1911), p. 198.

***Onobrychis sativa*, Lam.;** Sainfoin, Finger Grass.

Perennial, about 2 ft. high. Europe—France and southern parts, Great Britain—more especially in the south and east counties; United States. An excellent fodder plant for sheep especially. The ordinary variety is recommended for pasture and the var. *bifera*, "Giant" or "Double Yielding," for hay.

2. June, 1899, "Experiments in the Feeding of Sainfoin and Lucerne," pp. 39-44; June, 1906, "Sainfoin Seed," pp. 147-153; April, 1914, "Sainfoin (*Onobrychis sativa*)," pp. 43-46.

3. No. 280, 1916, *ibid.*, pp. 1-4.

***Arachis hypogaea*, Linn.;** Ground Nut, Pea Nut, Monkey Nut, &c.

Annual, low-growing; the pods are formed on the stem above the surface in the ordinary way, but turn and bury themselves in the ground to develop. There are several varieties and numerous forms divided primarily into "bunched," in which the stems grow erect and compact; and "running" in which the stems are more or less procumbent. The most important source is the Colony of the Gambia (1509849)* in Tropical Africa, which also includes supplies of Rufisque (Senegal), Egyptian, Mozambique, &c.; Spain; British India, Japan, United States, and Australia, and it is grown in many other tropical and sub-tropical countries. Experiments on a small scale to cultivate this plant in England have so far proved unsuccessful, and in view of the climatic requirements the result could only be expected. An important source of food in the countries where grown and also used in this country, but more important here as a source of oil. They may be used as dessert after being roasted, and manufactured into pea-nut butter. The oil is largely used as a substitute for olive oil. In Marseilles, where the seeds are crushed on a large scale, the shells are ground and sold as "Soga Meal," for use mixed with molasses as cattle feed. The plant is a good fodder and may be used in the green state or dried as hay.

1. 1901, "Ground Nut or Pea Nut," pp. 175-200.

1a. ix. '2 (1911), pp. 201-206.

2. July, 1915, "Ground Nut Cake," pp. 308-313.

3a. No. 64, 1916, "Ground Nut Cake."

***Desmodium tortuosum*, Swz.;** Florida Beggar Weed.

Annual, 3 to 10 ft. West Indies, United States—Florida, and other sub-tropical parts. A wild forage plant highly esteemed in the S. United States, giving a fodder of fine quality in large quantities; the haulms, though rather woody, are eaten by cattle and working stock of all kinds (*K.B.* 1896, p. 188); makes a fine quality hay that is relished by all classes of farm

* The imports to the United Kingdom are not readily available and this represents cents exported in 1913, less than 6 per cent. of which came into this country, the greater proportion being shipped to Germany and France (*Col. Rep. Ann.* No. 805, 1914, p. 8).

stock in Florida, where commercial hulled seed is wholly produced (Piper). Recommended by Kew in 1896 for cultivation in Australia, South Africa and the cooler parts of India.

Desmodium triflorum, DC., is a plant cosmopolitan in the Tropics, fed to cattle in India.

Lespedeza striata, Hook. & Arn.; Japan Clover.

Annual, 4 to 30 in. Japan, Manchuria, Corea, China, S. United States. In California it has spread over thousands of acres (Index Fl. Sinensis, i. p. 182). An excellent pasture plant and in situations favourable to full growth it may be cut for hay. "Spread in the United States from S. New Jersey westward nearly to central Kansas and south to the Gulf of Mexico," but "it is only in the lower Mississippi valley that it grows large enough to cut for hay, elsewhere being valuable only for pasturage" (Piper).

Cicer arietinum, Linn.; Chick Pea, Brown Gram or Black Gram, Bengal Gram, Horse Gram, Egyptian Pea, Idaho Pea, Garbanzo (Mexico, Spain).

Annual, 1 to 2 ft. India, Syria, Turkey, Spain, Bulgaria, Africa, Mexico, &c. The plant is grown chiefly for the production of seed, used for human food, considered one of the most nutritious of the pulses; the seeds are also good feed for horses, cattle, sheep, and poultry. The haulm is not suitable for fodder as the leaves contain an acid (oxalic chiefly) which in excess would be poisonous. "Leblebii" is a food made from the pea in Bulgaria and Turkey and said to be very useful in feeding children over 6 months old, especially when they have intestinal troubles (Inter. Rev. Agric. Rome, June, 1917, pp. 932-934).

The Customs Returns of Imports are included with those of "Dohl or Pigeon Pea" (*Cajanus indicus*) (q.v.). A considerable quantity of the Mexican produce is exported to the United States but the crop is mostly purchased in Mexico by special agents from Spain, who travel from hacienda to hacienda to buy (Bd. Trade Journ. May 18th, 1911, p. 361); the exports from Damascus go chiefly to Italy, France and Egypt (l.c. p. 360), from Beirut District, Turkey, to Egypt, Italy, United Kingdom and Malta (l.c. May 25th, 1911, p. 429), and large exports are also made by Morocco (l.c. June 1st. 1911, p. 478).

1a. ix. 2 (1911), pp. 207-208.

Vicia Faba, Linn.; Field Bean, Broad Bean.

Annual, 2 to 4 ft. China (1447017), Russia (75751), Germany (55384), British India (48295), New Zealand (17785), Netherlands (11401), Italy, Austria-Hungary, Turkey, Egypt, Morocco, United States, Canada, Mexico, &c., are the countries from whence imported, and in the same year (1913) the United Kingdom produced 3,040,989 centals. The Broad or Windsor Bean in various varieties is well known as a vegetable and the "Field" or "Horse" Bean (var. *equina*), including the cultivated forms "Heligoland," "Tick," "Red," "Mazagan," "Cluster," &c., is grown for feeding horses and cows.

2. Nov. 1910, "The Cultivation of Field Beans," pp. 631-636.

3. No. 268, 1913, *ibid.*, pp. 1-5.

***Vicia sativa*, Linn.; Vetch, Tare.**

Annual, 3 to 5 ft., including several varieties, varying chiefly in size and colour of the seeds, but the two main kinds are usually referred to as "summer" and "winter" vetch. Europe, especially Russia (66338—seed) and Germany (26567—seed); Turkey in Asia (6710—seed), United States, United Kingdom and in general countries with a cool climate suitable for the "Field Bean," which is often grown with it as a support. In Scotland the crop includes Beans, Mashlum (mixed grain), &c., for fodder. Important as a forage crop—soiling, hay, or ensilage, for all of which purposes it is usually cut before the seeds mature. The "Hairy," "Russian," or "Siberian Vetch" (*Vicia villosa*, Roth.) is grown for a similar purpose, it is wild in Germany, Russia, &c., which countries export large quantities of seed for cultivation in the United States, where the grey-seeded variety of the Common Vetch is also largely grown (Piper); the plant is resistant to cold, heat and drought. *Vicia tenuifolia*, Roth, var. *stenophylla* is valued in Cyprus as a fodder plant (Bovill, Mus. Kew).

- 2. April, 1915, "Suggestions for the Cultivation of Catch Crops and Home-Grown Feeding Stuffs," pp. 30-31.

3a. No. 28, 1916, *ibid.*, p. 10. Food Production, No. 7, 1917, "Maintenance of Supplies of Hay and other Fodder Crops—Vetch Mixture Hay," p. 2.

***Lens esculenta*, Moench.; Lentil, Masur (India).**

Annual, 1½ ft. British India (168280), Russia (12756), Germany (69697), S. Europe, N. Africa, Egypt, Syria, and most Eastern Countries; cultivated experimentally in Nyasaland. Probably the oldest food plant grown. There are various forms, differing chiefly in the size and colour of the seed; two varieties "Verte du Puy" and "Petit à la Reine" are much esteemed in France as a vegetable (Vilmorin); in India, where the plant is grown as a winter crop, it is considered the most nutritious of the pulses (Watt, Church), and the dry plant is used as fodder. In this country the product for human food comes in whole or "split," the most important source, as indicated above, being British India. The seed has been noted in poultry food mixtures. "Ervalenta" or "Revalenta Arabica" is an invalid food, made chiefly of lentil meal (noted in Treas. Bot. (1889), Mus. Guide, No. 1; Comm. Prod. India (1908), and advertised at the present day). The lentil was introduced into this country in the sixteenth century (Loudon, Lawson), but although the conditions are suitable, the cultivation never seems to have become of any importance.

***Lathyrus sativus*, Linn.; Chickling Vetch, Grass Pea, Mutter Pea,* Indian Pea, Khesári or Kesári (Bengal), Dog-**

* The true "Mutter" or "Mattar" Pea of India is *Pisum arvense*, the "Grey" or "Field" Pea.

tooth-pea,* Dent-de-brebist† or Sheep-tooth, Riga Pea,‡ Black Sea Pulse, Lakh, Lakhori.

Annual, 2 to 3 ft. high. No returns of imports into this country appear to be available; our principal source of supply is British India, and the figures are probably involved with those of Peas (see under *Pisum sativum*) from that country. The plant is cultivated in many tropical and sub-tropical countries, the seeds being used as food for both men and animals. The pods are sometimes eaten when green and the plant used as fodder. There is some danger in the use of this pulse for food; cases of poisoning are not uncommon and a disease known as "Lathyrism" is frequently produced—so far imperfectly understood; several hypotheses have been put forward as to the cause, and perhaps the simplest and most likely is that advanced by Major Buchanan after a special study of the causes. It is to the effect that the natives of India suffer more from this disease when compelled to live almost entirely on the pulse—an explanation that would fit many more so-called poisonous plants—and that paralysis is likely to occur when the proportion of Lathyrus reaches or exceeds half of the whole ration. The subject is too wide to enter upon here; it is fully discussed by Buchanan in "A Report on Lathyrism in the Central Provinces from 1896-1902" (Nagpur, 1904); Watt, Commercial Products of India (1908), "Lathyrism," pp. 705-706; Holmes in Pharmaceutical Journal, xxxvi. 1913, "A Poisonous Horse-Pea," pp. 795-796 and p. 837; Year Book of Pharmacy, 1913, pp. 276-278; Long in "Plants Poisonous to Live Stock" (1917), pp. 27-29.

"Tangier-Pea" (*Lathyrus tingitanus*, Linn.), an annual, native of North Africa, is grown for forage in Algeria.

1. 1894, "Lathyrus Fodder (*Lathyrus sativus*)," pp. 349-352.

***Pisum arvense*, Linn.;** Field Pea, Partridge Pea, Dun Pea, Grey Pea, Maple Pea.

Annual, 3 ft. or thereabouts. Probably native of S. Europe; cultivated under several varieties in most temperate countries (for trade sources see under *P. sativum*), and more or less throughout the United Kingdom (production in 1913—2133104 cents), where the counties of Essex, Kent, Lincolnshire, and Suffolk each grow more than 10,000 acres. Peas used for feeding stock, poultry, game and pigeons, and the haulms as fodder. In Idaho it has been found that "hogging off"—turning pigs on to the field—is a practical and convenient method of harvesting and feeding pigs (Univ. of Idaho, Agric. Bull. No. 92, 1916, pp. 6-8).

***Pisum sativum*, Linn.;** Garden Pea, Blue Pea.

Annual, 2 ft. and upwards; cultivated under numerous

* A sample said to be known in commerce under this name, imported from Odessa to Hull; identified at Kew as *L. sativus*.

† So-called by Vilmorin (Pl. Potageres, p. 283).

‡ Sample in Museum, Kew, of a large white-seeded form.

varieties as a vegetable in the green pod and on a field scale when the ripe seeds are harvested. "Harrison's Glory" is a variety grown largely in Suffolk, the seeds of which are put up into packets for sale as food. Pea canning is an important industry in the United States and the refuse is recommended there for forage. The Customs Returns (for 1913), as referring to the two species, are given below:—British India (1077832), Germany (248942), New Zealand (208312), Netherlands (201062), Russia (173734), Japan (167104), Canada (6462), Australia (6294), United States (3987), Belgium (1657), Chili (851), China (168). The foregoing figures refer to whole peas, and in addition Germany supplied 102,715 centals of split peas.

2. April, 1915, "Suggestions for the Cultivation of Catch Crops and Home Grown Feeding Stuffs—Peas," pp. 29-30.

3a. No. 28, 1916, p. 8.

Glycine Soja, Sieb. & Zucc.; Soy Bean, China Bean, Japan Pea, White Gram; &c.

Annual, $1\frac{1}{2}$ to 4 ft. high. Imports for the present are prohibited but the important sources are Russia (875526), China (816032), Japan (43209) and also cultivated in India, America, South Africa, and under experiment in several British Colonies. Considerable interest has recently been taken in the cultivation in England, but results of experiments made at Cambridge, Midland Agricultural College, South Eastern Agric. College, Wye, &c., go to show that no variety so far has been found that can be relied on to produce seed here. The varieties tried (16), of which there is a small sample of each in the Kew Museum, were obtained by the Board of Agriculture from North Japan (Exp. Station, Hamadate village), together with samples of the soil they grew in, for the purpose of inoculating the soil here. Several Manchurian varieties have been tried with like result. The variety "Early Tennessee," grown at Wye College, Kent, in 1910 is reported to have produced well-filled pods (2 *seq.*, March, 1916, p. 1287). Specimens of the plant of a North Manchurian variety grown in Regent's Park were shown at the recent food economy exhibition of the Ministry of Food at the Institute of Hygiene (Nat. Food Journ. March 13, 1918). The beans are an important food in the East; used like peas in this country, as a vegetable, in soups, &c. In Japan and China they are largely used in the preparation of the sauce known commercially as "Soy," and they make there a preparation used as a substitute for milk, and from this a food product called "Tofu," which in turn forms the basis of the bean cheeses of Japan. The meal in this country is used in the manufacture of biscuits and in making a bread for special use in diabetes; but the principal use here is for the extraction of the oil of which the beans contain about 18 per cent., suitable for soap-making and in general as a substitute for cotton seed oil, the residue being a valuable cattle feed. The plant is grown in the United States as a forage crop—soiling, hay and ensilage.

1a. ix. 2 (1911), pp. 211-214.

2. May, 1909, "Soy Beans," pp. 128-129; Dec. 1909, "The

Soy Bean," pp. 735-739; April, 1912, "Cultivation of Soy Beans in Britain," pp. 33-35; March, 1916, "The Soya Bean," pp. 1286-1287; Oct. 1916, "Extracted Soya Meal Poisoning," pp. 691-692.

Mucuna aterrima, *Holland*, in *Kew Bull.* Add. Ser. ix. p. 216; Bengal Bean, Mauritius Bean. **M. Deeringiana**, *Holland*; Velvet Bean, Florida Velvet Bean. **M. nivea**, *DC.*; Lyon Bean.

All annual and vigorous growing climbers cultivated in the tropics for forage. The most important plant is the "Velvet Bean," largely grown in Florida, Philippines, Transvaal, &c. Used in a green state and as hay for feeding stock. The beans are fit only for feeding animals, for which purpose they may also be ground into meal and used like cotton-seed meal.

1. 1898, "Florida Velvet Bean," pp. 207-208.

1a. ix. 2 (1911), "*Mucuna*," pp. 216-220.

Phaseolus aconitifolius, *Jacq.*; Moth Bean (India).

Perennial or annual, 1-2 ft. India, Ceylon, &c. Cultivated on a large scale in India for the beans used as food and the green pods are also used as a vegetable. The plant is an important fodder.

Phaseolus angularis, *Wight*; Adzuki Bean (Japan), Manchuria White and Red Bean.

Annual, 2½ ft. Japan, Corea, China, Manchuria. This bean appears to have been coming into the market recently in quantity. Trade samples have been submitted to Kew for name as "Dainagon Azuki Beans." They are an important human food in the countries mentioned, cultivated for the purpose.

Phaseolus calcaratus, *Roxb.*; Rice Bean.

Annual, trailer, 3 to 6 ft. India, Burma, China, Japan, Java, Mauritius, Philippines, &c. Cultivated for the beans, which are used as food. There are several varieties, with brown, black, maroon, and grey-marbled seeds. Not recommended in the United States either as a forage crop or for human food; the habit and shattering of the seed make the plant difficult to harvest (Piper).

Phaseolus lunatus, *Linn.*; Lima, Burma, Paigya, Rangoon or Java Bean, Duffin Bean, Small Mauritius Bean, Butter Bean, Madagascar Butter Bean.

A tall biennial, habit of the Runner Bean, climbing upwards of 8 ft., according to variety. Commonly cultivated in the Tropics and warm countries under many varieties, which vary especially in the colour, size and shape of the seeds—white, black, brown, reddish and mottled. The "Lima Bean" is largely grown in California (Irish), and other trade sources are chiefly British India and Madagascar (for imports see under *P. vulgaris*). The "Madagascar Butter Bean" is the one commonly sold by grocers, and also the small white seeds have been sold as "Haricot," "Rangoon Haricot," or "New

Haricot" beans. The other kinds mentioned under common names, with chiefly coloured seeds, are imported for feeding cattle. The white seeds are usually considered safe for food, but suspicion is always justifiably attached to coloured seeds, which have been found to contain undue proportions of prussic acid. In the Kew Museum there is a wide range of these beans which have been the cause of poisoning cattle, investigated by the Board of Agriculture. The Government chemist has found that "excepting that the white beans contain the lowest quantity (0.105 per cent.), the dark-brown (0.33 per cent.) and the black (0.32 per cent.), the highest quantity of prussic acid, it is not possible to draw the conclusion that there is any close relation between colour and amount of prussic acid in the beans." Particulars of the poisonous properties of this bean are given in the papers referred to below. The young pods may be cooked like "French beans," and the plant is an important fodder in India. Enquiries have recently been made as to whether this species will succeed in England. It was introduced to this country in 1779 (Loudon, who describes it as a "bark stove annual"), and although it may grow during the summer months out of doors it could not be depended upon to ripen seeds in the open.

2. March, 1906, "Poisoning of cattle by Java Beans," pp. 742-746; April, 1906, *ibid.*, pp. 52-53; March, 1908. "The Poisonous Properties of the Beans of *Phaseolus lunatus*," pp. 722-731.

Phaseolus Mungo, Linn.; Urd Bean (India), Black Gram.

Annual, 1 to 4 ft. a variable plant. Tropical India, Africa, &c. In India one of the most important crops; the green pods and ripe seeds used as food and the plant as fodder.

Phaseolus radiatus, Linn. (*P. aureus*, Roxb.); Mung (India), Mung Pulse, Green Gram, Golden Gram, Jerusalem Pea (Jamaica).

Annual, 1 to 2 ft., a variable plant. India, where there are three leading varieties under cultivation, the "Mung" or "Chegt Mung" (var. *typica*), seeds green; "Sona Mung" (var. *aurea*), seeds yellow, the most esteemed form and "Krishna Mung" (var. *grandis*), seeds black, the least esteemed form (Prain, Journ. Asiat. Soc. Bengal, lxvi. 1897, p. 422). Grown also in Malaya, Tropical Africa, &c. Seed used for food and fodder and the straw is also used for fodder.

Phaseolus vulgaris, Linn.; Haricot Bean, Kidney Bean, French Bean.

Annual, a foot or so high, including upwards of 200 varieties cultivated in many parts of the world—tropical, sub-tropical and temperate. The principal sources of "Haricot Beans" are Madagascar (80438), British India (76048), France (36849), Germany (35661), Chile (28392), Austria-Hungary (27305), Belgium (24575), Roumania (9609), Italy (5902), Netherlands (5241), United States (2900), Russia (1288), and Japan (1232).

The seeds may be white, black, yellow, brown, red, and

various shades of these colours, or variegated. It is usually the white kinds that are used for human food, but certain coloured ones, as, for instance, "Canadian Wonder" are also considered good as "shell beans" in America—that is when the beans are in a soft, green condition, but large enough to shell. "Boston Baked Beans" are prepared from the variety "Navy," with a white seed, much used in baking and for stock food, for which purpose it is grown largely as a field crop in America; the pods are inferior for cooking purposes (Irish); "Golden Cranberry" is stated by the same author to be universally cultivated. A coloured bean, "Brown Holland" or "Dutch Brown" is grown in Holland in large quantities for food, the ripe seed being used: it is not suitable for use in the pod. Experiments were made with success in this country at Kew and at Wisley in 1916, and the Royal Horticultural Society distributed for cultivation a ton of these beans obtained from Holland in 1917 (Journ. Roy. Hort. Soc. xlii. 1917, p. 433). Recently some coloured beans, chiefly from Brazil and Chile, have been coming into the market, and from samples submitted to Kew for identification, they are all apparently varieties of *vulgaris*, intended for feeding to stock. In some cases they have been reported as unwholesome. Although there is no reason so far to suspect the varieties of this species as being poisonous in the same way as those of *lunatus*, careful experiments should be made in feeding with a new bean, and under no circumstances should a whole ration be given at one time. In reference to recent imports of Brazilian beans for use as cattle food it is reported (Journ. Bd. Agric. seq. p. 124) that in the beans examined (brown in colour and about the size and shape of a small haricot bean) "there was complete absence of any poison and the analysis showed that the beans should prove of good feeding value" and, "that the trouble which has arisen in the use of this bean has been due to the fact that farmers have not boiled, steeped, or soaked the meal previous to feeding." With this proviso the beans are considered excellent for feeding stock. Boiled and mixed with hot mash is recommended, preparatory to feeding poultry, which otherwise refuse to eat the bean. The French Bean is usually grown in this country for the green pod, amongst which two well-known varieties are "Canadian Wonder," above mentioned, and "Ne Plus Ultra." The name "Butter Bean" here refers to yellow-podded varieties, including "Mont d'Or," "Golden Wax," "White Algerian," or "Tall White Algerian Butter Wax" (Vilmorin), &c.

The "Scarlet Runner Bean" (*Phaseolus multiflorus*, Willd.), is a perennial plant of Mexico, but usually grown as an annual for the green pods only as a vegetable. Suggestions have been made to use the haulms of this plant in hard times for feeding cattle, rabbits, &c., but it may be said, apart from the uncertain value as fodder—though the roots are poisonous—there is no record at hand of the haulm being injurious, the small quantity available before the plants finish bearing, when the dry, bare vines would be poor stuff for feeding, makes it scarcely worthy of consideration.

1a. ix. 2 (1911), "*Phaseolus*," pp. 224-228.

2. Jan. 1919, "The Use of Brazilian Beans for Feeding Purposes," pp. 1239-1240.

Vigna Catiang, *Walp.*; Cow Pea, Catiang Bean.

Annual, climbing upwards of 6 ft. Tropics, Sub-tropics and countries with long hot summers. The green pods and ripe seeds are used everywhere as food and the plant as fodder. There are many varieties under cultivation, differing in size and colour of the seed and in habit, the white seeded kinds being generally considered the best. A form with long pods is sold by market-gardeners in India (Watt) and the young pods of "*Dolique Mongette*" are eaten in France and Italy (Vilmorin) as a substitute for "French Beans." The Cow Pea is one of the standard forage crops, for hay and pasture, in the S. United States (Lyon and Hitchcock, U.S. Dept. Agric. Bur. Pl. Ind. Bull. No. 59, 1904, p. 47). As a forage crop it is recommended in N.S. Wales for cultivation with "*Maize*" (*Zea Mays*) up the stems of which the vines climb (Hadfield, Agric. Gaz. N.S. Wales, Aug. 1914, p. 657), and it is similarly grown in India (Watt). For feeding pigs it is estimated that an acre of ripening cow-peas will pasture 15 to 20 animals for several weeks (Queensland Agric. Journ. vi. 1900, p. 269).

1a. ix. 2 (1911) pp. 228-230.

Dolichos biflorus, *Linn.*; Horse Gram, Kulti or Kulthi (India).

Annual, 3 ft. India, Burma, Ceylon, Tropical Africa, etc. The imports into the United Kingdom are in the main probably from British India, the returns not being readily separated from those of other kinds of "gram." Important as food and fodder. Church states that the long continued use of the beans as food is regarded as injurious; they are reputed in some districts to cause oedematous swellings.

1a. ix. 2 (1911) p. 234.

Dolichos Lablab, *Linn.*; Lablab Bean, Indian Butter Bean, Hyacinth Bean, Bonavist Bean (West Indies).

Annual climber, 10 to 15 ft. There are two well marked varieties—one with white flowers and white seeds, the other with violet flowers and seeds dark-brown to black. Tropical Asia, Africa, and America. Used as food, both the green pods and ripe seed. Dr. Leather (Agric. Journ. India, i. 1906, "Cyanogenesis in Plants," p. 224) has found prussic acid in the seeds; but some seeds (brown) recently submitted to Kew for identification were found by Dr. Voelcker to be free from any cyanogenetic glucoside.

1a. ix. 2 (1911) pp. 234-235.

Cajanus indicus, *Spreng.*; Pigeon Pea, Congo Pea, Angola Pea, Dhol or Dhal (India), Bombay Tare.*

Perennial, usually grown as an annual, 8 to 9 ft. The principal source of supply to the United Kingdom is British

* Seed submitted to Kew, for identification, under this name.

India (639060) [see also "Chick Pea, *Cicer arietinum*], also cultivated in Tropical Africa, Venezuela, Madagascar, Philippines, Mauritius, West Indies, Guiana, Australia, and other hot countries. Used as food—the tender green pods, the young green peas, and the ripe ones whole, split or ground into meal. The young shoots and the leaves stripped off at the time the peas are harvested, make good fodder for cattle. The plant is specially grown in Bengal and Assam for feeding the lac insect, and in Madagascar and the Antilles for feeding silkworms.

1a. ix. 2 (1911) pp. 236-237.

Ceratonia Siliqua, *Linn.*; Locust Bean, Carob Bean, Algaroba (Spain).

A tree, 15 to 25 ft. high. Native of S. Europe and the Mediterranean region; wild and cultivated in N. Africa; naturalized in certain parts of India and cultivated in the West Indies, &c. Principal trade sources of the pods are Cyprus (459131), Portugal (152452), Turkey in Asia (58336), Algeria (21470), Italy (2174). The beans are an important food for stock, including cattle, horses, and pigs. Trees begin to bear fruit after about 3 years from grafting on stocks about 2 years old.

1a. ix. 2 (1911) pp. 261-263.

Prosopis juliflora, *DC.*; Mesquit Bean, Algaroba, Honey Locust.

A deciduous tree up to 50 ft. high. Native of the West Indies and Central America; introduced to many British Possessions, including Australia, South Africa, India, West Indies, &c. Seeds obtained from the Mohave Desert, California, by the Foreign Office, were distributed from Kew in 1875. The best reports of success in establishing trees came from India—Punjab and South Australia (see Kew Rep. 1879). The pods are a good food for cattle, horses and pigs, though death has resulted on occasion after eating damp or undried pods, owing, it has been suggested, to the germination or swelling of the seed in the stomach. They are an important article of food with the Indians and Mexicans, who grind them into flour for baking purposes. In Hawaii, where the plant has been introduced, it appears to have become thoroughly naturalized, growing wild along the sea coast, and it has been the means of enabling this island to develop an important trade in "Algaroba Honey" (See "Hawaiian Honeys," by Van Dine and Thompson, Hawaii Exp. St. Bull. No. 17, 1908, pp. 8-9), doing, it would seem, what "Logwood" (*Haematoxylon campechianum*) has done for Jamaica in producing its famous "Logwood Honey."

1a. ix. 2 (1911) p. 285.

Enterolobium Saman, *Prain* (*Pithecolobium Saman*, *Benth.*); Guango, Rain Tree.

A large deciduous tree up to 60 ft. high. Native of Tropical America, introduced to the West Indies, India, West Africa, Queensland, &c. In Jamaica it was introduced from the mainland and was reported in 1878 to have then become naturalized

in all the dry regions. From this Colony seeds were obtained and distributed by the Director, Kew, to other Colonies and India. In reference to India, Sir G. King in 1878 reported the tree as "a more hopeful source of cattle fodder than the Carob" (*Ceratonia Siliqua*) (see Kew Rep. 1878). The mature pods are good fodder for stock, for which purpose they are largely used in Jamaica. In many countries where this tree has been introduced it is principally valued as an ornamental shade tree.

la. ix. 2 (1911) pp. 300-301.

"African Locust Beans" (*Parkia biglobosa*, Bth. & P. filicoidea, Welw.), West Africa; pulp of the pods eaten (K.B. 1908, pp. 314-315; Add. Ser. ix. 2, pp. 281-282).

"Bambarra Groundnut" or "Mozambique Gram" (*Voandzeia subterranea*, Thouars), Tropical Africa; seed used as food (K.B. 1906, pp. 68-70).

"Chiga Bread" (*Campsandra comosa*, Benth.), a tree of tropical South America, from the seeds of which a flour is obtained, used for making bread (K.B. 1889, pp. 71-72).

"Doi" or "Dohi" (*Kerstingiella geocarpa*, Harms.) of Dahomey and Yoruba; beans used like those of "Haricot" (K.B. 1912, pp. 209-213).

"Birds Foot Trefoil" (*Lotus corniculatus*, Linn.), Britain, a small plant in mixed pastures, eaten by all kinds of stock.

"Fenugreek" (*Trigonella Foenum-graecum*, Linn.), native of the Mediterranean region, cultivated in Turkey and India, seeds used as a condiment for stock.

"Guar" (*Cyamopsis psoralioides*, DC.), India, where the plant is cultivated both as a green forage crop and for the seed used as a cattle feed.

"Kuzu" or "Kudzu" (*Pueraria Thunbergiana*, Bth.), of Japan. A large climber, 40 to 60 ft. in length, with large tuberous roots from which a starch is made for use as food; the leaves are fed to cattle. In the United States it has recently attracted some attention as a forage crop; "the leaves and cured hay are eaten freely by horses and cows and for permanent hay fields, especially in the south it is likely to become of some importance" (Piper). Some enquiries were made at Kew during 1917 as to the suitability of this plant for cultivation in England. It is not probable that it would be of any value here as the seeds do not ripen freely outside Japan, and cuttings or layers, the alternative method of propagation, would be costly on a field scale; moreover, the plant will not stand frost and the experience in the United States (*idem*) is that the field does not produce the best results until the third year.

"Prairie Turnip" (*Psoralea esculenta*, Pursh.), of North West America, where the tuberous roots are largely used as food by the aborigines.

"Serradella" (*Ornithopus sativus*, Brot.), of S. Europe and Morocco, grown for forage in Spain, Portugal, France, Germany, &c.

"Sword Bean" or "Jack Bean" (*Canavalia ensiformis*, DC.), cosmopolitan in the Tropics; cultivated in many parts for the young pods, eaten like "French Beans." The beans are some-

times eaten, the white kinds being the best, though they are considered indigestible unless the outer skin is removed. In Hawaii the green plant has been found to be both palatable and nutritious for feeding dairy cows and swine, and the green beans and Sorghum have been fed with excellent results (Hawaii Exp. St. Bull. No. 23, 1911, pp. 19, 20).

Tetrapleura Thonningii, Bth., of West Africa; pods used roasted and ground, in the preparation of black soup, a common native food.

"Yam Beans" (*Pachyrrhizus angulatus*, Rich. and *P. tuberosus*, Spreng.), cultivated in the Tropics; the tuberous roots are edible and a starch is obtained from them (*K.B.* 1889, pp. 62-63 and p. 121; 1895, pp. 47-48, with analyses of tubers and seeds said to contain a poisonous resin).

"Yeheb" (*Cordeauia edulis*, Hemsl.), a small bush found in great quantities in the "Haud" or waterless desert of Somaliland, where the nuts form the staple article of food of the poorer classes of native (*K.B.* 1908, pp. 36-44; 1910, pp. 398-400).

The following may be referred to for general information on the Order:—

"Garden Beans Cultivated as Esculents," H. C. Irish in 12th Report, Missouri Botanic Garden, 1901, pp. 81-165; pls. 38-47.

"Inoculation of Leguminous Plants," Journ. Bd. Agric. xii. Feb. 1906, pp. 641-659.

"American Varieties of Garden Beans," W. W. Tracy, U.S. Dept. Agric. Bureau Plant Industry, Bull. No. 109, 1907, pp. 1-155; pls. i.-xxiv.

"Leguminous Crops for Hawaii," F. G. Krauss, Hawaii Exp. St., Bull. No. 23, 1911, pp. 1-31, illustrated.

"Some New or little-known Leguminous Feeding Stuffs," in Bull. Imp. Institute, xi. 1913, pp. 230-243.

"Five Oriental Species of Beans," C. V. Piper and W. J. Morse, U.S. Dept. Agric., Bull. No. 119, 1914, pp. 1-32.

"Leguminous Crops in Desert Agriculture," A. Howard and L. C. Howard in The Agric. Journal of India, xii. Jan. 1917. pp. 27-43.

"The Peas and Beans of Commerce," Bull. Imp. Inst., xv. 1917, pp. 503-544.

GRAMINEAE.

***Paspalum dilatatum*, Poir.;** Hairy-flowered Paspalum, Large Water Grass, Leichardt Grass, Golden Crown Grass.

Perennial, 2 to 4 ft. and sometimes 6 ft. in height. Brazil, Argentine, Uruguay; distributed to the Gulf States and Florida. Introduced to Australia—New South Wales, Queensland, Victoria, and West Australia; India, British East Africa, Natal, and New Zealand (but is reported not to stand the winter here) and found also in Porto Rico, Mauritius, and Straits Settlements. An excellent hay and pasture grass, suitable for warm countries; recommended in countries with mild winters, to be grown with "Cocksfoot" (*Dactylis glomerata*, Linn.), or similar grass that grows in a cold climate.

1. 1902, "An American Fodder Grass," pp. 1-4.

Amongst other *Paspalums* for fodder may be mentioned (see *K.B.* 1894, Trop. Fodder-Gr.) "Sour Grass" (*Jamaica*), "Green Grass" (*Singapore*) (*P. conjugatum*, Berg.) 1 to 2 ft. high, found in Tropical America, Africa, Ceylon, East Indies, &c. "Silt Grass," "Water Couch" (*P. distichum*, Linn.) of Tropical America, Australia, &c., "Ditch Millet" or "Kodo Millet" (*P. scrobiculatum*, Linn.) of India and other tropical parts of the East; recommended for pasture and hay, but said to be more or less poisonous to animals at the time of ripening.

***Panicum frumentaceum*, Roxb.** (*P. Crus-galli*, Linn., var. *frumentaceum*, Trimen. *Echinochloa frumentacea*, Link); Japanese Barnyard Millet, Sanwa Millet (India), Billion Dollar Grass (America).

Annual, 2 to 4 ft. Japan, India, Africa, Southern States of America, and many other warm countries. Seed used for food, especially in the East; though Church states that it "does not take a high place among the millets for food." The plant, perhaps best cut green, is cultivated in some countries for fodder.

***Panicum maximum*, Jacq.;** Guinea Grass.

Perennial, 3 to 6 ft., native of Tropical Africa. Cultivated in many tropical countries, including Brazil, Cuba, Jamaica, and other parts of the West Indies, India, Gulf Coast, and Florida. One of the best fodder grasses in the Tropics; recommended as a soiling crop and cut before the stems get hard and woody, may be used as hay and silage.

1. 1894, pp. 382-383.

***Panicum miliaceum*, Linn.;** Broom Corn Millet, Chena or Indian Millet.

Annual, 2 ft., but a variable plant. India, Ceylon, China, Japan, Persia, Egypt, Russia, America, &c., where it is cultivated for the seed used as food, and the plant more or less for forage.

***Panicum muticum*, Forsk.** (*P. barbinode*, Trin.); Para Grass, Mauritius, Scotch, Water, or Buffalo Grass.

Perennial, 3 to 4 ft. high. A tropical species known in Brazil, West Indies, Florida, Gulf Coast, Curaçao, Ceylon, Mauritius, Bengal, Australia. It is largely used in Brazil, the chief fodder grass of Ceylon, and in general it is regarded as one of the best of tropical grasses for pasture. This grass is of interest as being one of the earliest (1849) of plants in which Kew has been instrumental in distributing to the Colonies.

1. 1894, pp. 384-385.

Other *Panicums* of interest are "Little Millet" (*P. miliare*, Lam.), an annual 2 to 3 ft., cultivated in India for the seed as food and the plant for forage. "Shama Millet" (*P. colonum*, Linn.), grown for food and fodder in India. "Angola Grass" or "African Wonder Grass" (*P. spectabile*, Nees.), of Tropical Africa and America; a strong growing plant, 5 to 6 ft. high, suitable for moist situations (Barter describes it as an aquatic

grass, 6 ft. high, on the Niger), recommended as a fodder for cattle. "Blue Grass," "Colorado Grass" (*P. texanum*, Buckley), an annual plant 2 to 4 ft. high, valued for hay in Texas.

***Digitaria exilis*, Stapf; (*Paspalum exile*, Kipp.); "Fundu" (W. Africa), Hungry Rice (Sierra Leone).**

Annual, 1½ ft. high and upwards, native of West Africa, found in Sierra Leone, French Guinea, Nigeria, Togoland, &c.

***Digitaria Iburua*, Stapf; Iburua (Hausa).**

Annual, 1½ ft. high and upwards, native of Nigeria.

Both of the above are largely cultivated for the grain, used as food in the countries to which they are referred; they are remarkable for their minute grains—upwards of 50,000 to the ounce and are such that it is only in countries where labour is very cheap that they would find a place in the dietary.

I. 1915, "Iburu and Fundu, Two Cereals of Upper Guinea," pp. 381-386.

***Setaria italica*, Beauv.; Foxtail Millet, Italian Millet, Boer Manna, Hungarian Grass.**

Annual, 2 to 4 ft. tropical and sub-tropical countries. In India and many other warm countries the grain is largely used for food and also in India for cage-birds and poultry. In Europe and America the plant is of greater importance as forage, especially for cattle. "Foxtail Millet" has long been regarded as unsatisfactory for horses unless fed sparingly (Piper), and this injurious effect upon horses is attributed to the seed if the hay is cut too late (Lyon & Hitchcock). Boer Manna is the staple hay crop in the Transvaal.

***Pennisetum purpureum*, Schum.; Elephant Grass, Napier's Fodder.**

Perennial, 8 to 10 ft. high, native of Tropical Africa. Recommended as a fodder plant in Rhodesia, Cameroons, Uganda and other parts of Africa.

I. 1912, "Elephant Grass, A New Fodder Plant," pp. 309-316.

***Pennisetum typhoideum*, Rich.; Pearl Millet, Bulrush Millet, Gero (African), Cumboo or Spiked Millet, Bajra (India).**

Annual, 3 to 6 ft. high. Tropical Asia and Africa. Introduced to the United States. The grain is largely cultivated in Africa and India, where in many parts it is the staple food of the natives, and in India the plant is sometimes cut green and also after the grain is ripe, for fodder. In the Southern United States it is grown as a forage crop, used more particularly as soilage, cut before the stems become hard and woody. The crop in the grain is usually subject to much loss by birds and might therefore be recommended for feeding poultry and game in this country. A sample of grain, with this view, was recently submitted to Kew for identification.

"Kikuyu Grass" (*P. longistylum*, Hochst.), of British East

Africa, has recently come under consideration at Kew as a fodder plant of promising value. "Arabjeb" (*P. ciliare*, Link.; syn. *P. cenchroides*, Rich.), is a good feeding grass in Somaliland, and in the same country *P. dichotomum*, Delile, is a good fodder for camels.

Euchlaena luxurians, Miers.) (*E. mexicana*, Schrad.); Teosinte, Buffalo Grass.

Annual, 6 to 8 ft., sometimes 15 ft. high, native of Mexico and Guatemala. A valuable fodder plant, widely distributed from Kew about 40 years ago to the East and West Indies, Australia and Tropical Africa. It is also cultivated in the Southern United States for fodder, used either as green feed or as ensilage.

1. 1894, "Teosinte," pp. 380-382.

Zea Mays, Linn.; Maize, Indian Corn, Corn.

Annual, 4 to 6 ft. high, including many varieties. Cultivated throughout the Tropics and Sub-tropics. The chief sources of supply of the grain to this country are Argentine (43516562), United States (7704816), Russia (1886192), Roumania (1122576), Canada (236880), British India (133168), British West Africa (200816), British South Africa (38864), Bulgaria, Turkey, Egypt, Morocco and Uruguay, the total imports amounting to 55,053,547 centals in 1913. The grain is a staple food wherever grown, and in the United States it is the chief source of alcohol. Maize corn is commonly used for feeding to stock, parrots, poultry and game. The cake made from the germs after expression of the oil is recommended as a good feed for animals, especially dairy cows. The plant is also grown for forage, cut and fed green, as ensilage or dried as hay. In England maize cannot be relied on to mature seed, but as a forage plant it is reported to do well in some parts of Cheshire, although as a rule it is not to be depended upon north of the Midlands (Journ. Bd. Agric. May, 1918, p. 233). The result of three years' experiments at the East Anglia Institute of Agriculture show that the American varieties "Improved Leaming," "Eureka," and "Wood's Northern Dent" are heavy yielders of green fodder (i.e. June, 1915, p. 265).

2. Dec. 1898, "Maize Products of the United States," pp. 392-395; March, 1902, "The Cultivation of Maize for Fodder," pp. 470-472; June, 1902, "Maize Growing Experiments," pp. 71-73; "Maize Ensilage," pp. 80-81 and "Maize Oil and Maize Oil Cake," p. 111; March, 1903, "Experiments in the Growth of Maize for Fodder," pp. 510-515; July, 1906, "Utilization of Green Maize for Fodder," pp. 229-230; April, 1907, "Maize as a Fodder and Silage Crop," pp. 14-22; Dec. 1907, "Feeding Pigs on Maize and Maize Meal," pp. 542-543; May, 1912, "Varieties of Maize for Forage Purposes," p. 136; May, 1918, "Growing Maize for Fodder," p. 233.

3. No. 73, 1908, "Cultivation of Maize for Fodder," No. 7, 1911, "Catch Crops and Fodder Supply," p. 4.

3a. No. 44, 1915, "Preserving Green Maize."

Zizania aquatica, Linn.; Canadian Wild Rice.

Aquatic annual, 9 to 12 ft. high, native of Eastern North America, where the seed or "wild rice" is an important food of the North American Indians. In Minnesota and other States it is a common food of wild duck and other wild-fowl. This grass is of interest as growing remarkably well at Kew and that special efforts have been made to acclimatise it in the United Kingdom; seed obtained from Canada being distributed to 23 estates in various parts of the Kingdom about 1909, the object being to augment the food supply of water-fowl. There is little evidence to show, however, that the seed will ripen properly in England. "Manchurian Water Rice" (*Z. latifolia*, Turcz.), an aquatic perennial, similar in habit to the foregoing, also grows well at Kew on the margins of the lake. It is a native of Manchuria, Corea, Japan, also occurring in China, where it is cultivated on flooded ground as a vegetable—the young shoots being used, called "Kiao Cabbage", or "Kiao Shoots."

1. 1900, "Indian Rice or Water Oats," p. 29; 1909, pp. 381-390.

Oryza sativa, Linn.; Rice.

Annual. Cultivated throughout the Tropics and in many sub-tropical countries under numerous varieties. The sources of supply are chiefly British India (2832299), Holland, Siam, Java, Straits Settlements, Spain (Alicante, Valencia, Castellon and Tarragona), Italy, Egypt, Japan, French Indo China, United States, Germany, Austria-Hungary, and Turkey, the total imports from all sources amounting to 4,801,130 centals (in 1913), including grain whole and cleaned and that in the husk. Known everywhere as a food. "Patna," "Rangoon," "Siam Garden," "Java," "Carolina," "Japan" and "Japanese Unpolished" are important commercial descriptions.

1. 1888, "The Cultivation of Rice in Bengal," pp. 284-291; 1892, "Black Burmese Rice," pp. 232-234; 1909, "Padi," pp. 277-279.

2. March, 1902, "Feeding Rice Meal to Pigs," pp. 518-519.

Melinis minutiflora, Beauv.; Brazilian Stink Grass, Honey Grass, Molasses Grass.

Perennial, 3 to 4 ft., native of Brazil and occurring in Tropical Africa, Madagascar, Ascension Island; introduced to Queensland, West Indies, Southern United States, &c. An excellent fodder plant valued in Brazil for horses and cattle; may be used green or as hay; but recommended to be cut before the seed-heads show.

1. 1900, "Brazilian Stink Grass," p. 31.

Saccharum officinarum, Linn.; Sugar Cane.

Perennial, 8 to 12 ft. high. Grown in all tropical countries; the chief producers, without reference to relative importance, being Cuba, British India, Java, Mauritius, Formosa, Philippine Islands, Queensland, New South Wales, Fiji, West Indies (English, French, and Danish), Guiana (English and Dutch).

Porto Rico, Hawaii, Central America, Mexico, Venezuela, Peru, Surinam, Brazil, Argentina, Louisiana, Egypt, Natal and Mozambique. Of these it will be sufficient to note that the three first-named are the only countries producing over a million tons (more than 22 million centals) each and that the United Kingdom relies more or less on all of them for supplies. In 1913, 8,279,242 centals of raw sugar were imported, of which Cuba contributed 5,022,692 (crop* harvested Dec.-June, 1912-13 was 54,399,229 centals), Java,† 2216 (crop harvested May-Nov., 1912-13—29,818,432 centals), and British India‡ 86,246 centals (crop harvested Dec.-May, 1912-13, 57,872,640 centals).

The sugar prepared from the juice of the cane is an important food throughout the world. The molasses (the liquid remaining after separation of the sugar crystals) is also used for food purposes, and mixed with other suitable substances—"Ground nut shells," see "Soga meal" (*Arachis hypogaea*), crushed "sugar-cane" ("Molascuit"), &c., it is a recognised cattle feed. In Mauritius and most of the sugar producing countries, during the harvesting season the tops of the cane are used for feeding both horses and cows.

A "Japanese Sugar Cane" or "Zwinga Sugar Cane," a variety with numerous slender stems, has been introduced to the Southern United States, grown for forage and extraction of syrup (Piper).

1. 1888, "Seedlings of Sugar Cane at Barbados," pp. 294-296; 1890, "The Sugar Production of the World," pp. 38-43; 1891, "Production of Seed and Seminal Variation in the Sugar-Cane," pp. 10-24 and "Production of Cane-Sugar in the Sugar-Cane," pp. 35-41; 1894, "Seminal Variation in the Sugar-Cane," pp. 84-86; "The Lahaina Sugar-Cane," pp. 418-419; "Improvement of Sugar-Cane by Chemical Selection of Seed-Canes," pp. 86-96; 1899, *ibid.*, pp. 45-46, "Sugar-Cane in the Sandwich Islands," pp. 201-203, 1897, "West Indian Sugar Trade," pp. 92-96, "Grafting Sugar Cane," pp. 221-223; 1912, "Sugar," pp. 168-169, pp. 179-180; 1914, "The Cultivation of the Sugar-Cane in Southern Spain," pp. 147-150.

2. June, 1898, "The Sugar Industry of Russia," pp. 69-71; June, 1901, "Molasses and Dairy Cows," pp. 45-47; Sept. 1903, "Exemption of Duty of Molasses used for Food for Stock," p. 260; May, 1911, "Molasses and Sugar Foods for Live Stock," pp. 97-106; March, 1916, "The Growing of Sugar," pp. 1210-1214.

Sorghum bicolor, Moench, var. obovatum, Stapf.

Annual, up to 14 ft. Cultivated in Angola, Mediterranean region, Madeira, India, Australia, West Indies and Brazil, more or less for the grain.

* For figures as to Crops, see "The International Sugar Journal, March, 1915, p. 149, and for those relating to Imports, Ann. St. Tr. U.K. i, 1917, as stated in introduction.

† The figures for Java are small in proportion to the imports for 1912 and 1914, which for those years averaged more than those given above for Cuba.

‡ The low import in proportion to the crop would indicate that the greater part is consumed locally.

Sorghum Caffrorum, Beauv.; Kahr Corn.

Annual, a variable plant up to 6 ft. high, including several races cultivated in Lower Guinea, South Africa, Mauritius and North America, for the grain and recommended for forage because of the sweet stems.

Sorghum caudatum, Stapf.

Annual, 14 ft., native of Tropical Africa, where it is commonly cultivated under several varieties for food; introduced to Tropical America and Jamaica. The variety "Feterita," common in Egypt and the Anglo-Egyptian Sudan, is an important food-grain, which, owing to its whiteness, has been recommended for making bread. An experiment with good quality wheat flour and 25 per cent. of "Feterita" flour was made at the Hygiene Bureau, Florence, and the resultant loaf described as well risen, light, uniform in colour, excellent in flavour and superior to that of other bread made from wheat, with the addition of rice, rye or potatoes (*see* Bull. Agric. Intell. Inter. Inst. Agric. Rome. July, 1915, pp. 983-984). This variety has been introduced to Arizona and other parts of the Southern United States as a forage crop.

Sorghum cernuum, Host.; Guinea Corn.

Annual, 10 ft. high and upwards, native of Upper Guinea. A staple food-grain in West Africa from Senegal to the Cameroons and in North Africa, and also grown in Egypt, India, Asia Minor, &c. Under the Bornu name of "Mazaggua" ("dry season corn") this is being experimented with in the West Indies, Rhodesia and other Colonies.

Sorghum Durra, Stapf; Durra.

Annual, 14 ft. and upwards, native of the Nile region. There are several varieties commonly cultivated in Egypt, Arabia, India, Afghanistan and the United States for the grain.

Sorghum guineense, Stapf; Dawa (Hausa), Guinea Corn.

Annual with tall stems, including three well-marked varieties, **tremulans**—grain white or reddish, **involutum**—grain white, **robustum**—grain reddish, and numerous cultural races, all natives of Upper Guinea, where the grain is a staple food. "Karandeffi" is a form under the var. *robustum*, the grain of which is said to give colic to animals, and the plant appears to be grown largely for dyeing Kano leather (specimens in Herb. Kew).

Sorghum halepense, Pers. (*Andropogon halepensis*, Brot.); Johnson Grass, Aleppo Grass, Evergreen Millet, Means Grass (S. Carolina), False Guinea Grass.

Perennial, 3 to 15 ft., native of Western Asia; found in India, Burma and Ceylon and the Mediterranean region; naturalized in the hotter parts of the United States. Seeds eaten by the poorer classes in India, where the plant is largely used for grazing and for hay; but it is regarded as injurious to animals if eaten too

young or stunted by drought (Watt). Cases of poisoning cattle have occurred in Montana and California; but no cases have been reported from the Southern States where the grass is most abundant, used both for pasture and as hay (Piper). In this respect, in common with other species of the genus, it evidently requires some care, especially when fed green. Where the plant finds a home, it spreads so readily that the difficulty seems to be not to grow it but to keep it under control.

1. 1914, "Poisoning by *Sorghum halepense*," pp. 229-230.

***Sorghum Roxburghii*, Stapf; Shallu (India).**

Annual with stout, tall culms, including several varieties, cultivated in India, Africa and in the United States for the grain.

***Sorghum saccharatum*,* Auct. viâ Linn.; Sugar Sorgo.**

The Sugar Sorghums are annuals upwards of 10 ft. or so in height, containing in their stems sufficient juice from which sugar may be extracted on a commercial scale. Other Sorghums, it may be noted, contain a sweet juice, notably amongst the "Kafir" group (see *S. Caffrorum*), but not enough to justify their use for the extraction of sugar. The preparation of Sorghum sugar and syrup is of some importance in the United States, though as an industry it is small in comparison with that of "Sugar-Cane," and "Sugar Beet." Experiments were being made about 1880, and it is interesting to note that of the varieties grown at that time there are three—"Early Orange," "Early Amber" and "Honey Cane," in the collection presented by the United States Department of Agriculture to the Museum at Kew in 1882, that are enumerated by Piper with "Sumac," "Gooseneck" and "Planter" as being the principal Sorghos cultivated at the present time. The varieties belonging to this group may also all be grown for forage.

"Great Millet" or "Guinea Corn" may, with the exception of *S. halepense*, properly apply to all of the above species of *Sorghum*, as these names were always associated with *Andropogon Sorghum*, Brot. var. *vulgaris*, Hack. (*Sorghum vulgare*, Pers.), and Africa† is believed to be the home of most, if not all, of the cultivated plants that could be included under these names. Broadly, the cultivated Sorghums are sometimes divided into juicy and sweet-stemmed and dry-stemmed. They are grown chiefly for the grain, sugar and syrup from the stem, forage and for brooms. In Africa and Asia the grain for food is probably the most important element, and in the United

* This name is used here to apply to American Sugar Sorgo; but originally (Linn. Sp. Pl. ed. i) it was meant for *S. Roxburghii* or a form closely allied to it. In the second edition Linnaeus completely changed the diagnosis so as to fit it to a sweet stemmed form of the group of *S. bicolor*, Nees (*Andropogon bicolor*, Kunth; *Holcus bicolor*, Linn.). To this *S. saccharatum* of the second edition, some specimens received from Egypt as *S. saccharatum* appear to be referable; but whether they are identical with Piper's "Sorgo" I cannot say. O. Stapf.

† See the recent exposition of the genus *Sorghum* by Dr. Stapf in "The Flora of Tropical Africa," vol. ix., part i. (1917), pp. 104-154.

States, where also sugar and syrup is obtained (see *S. saccharatum*), the use for forage appears to come first. The grain in this country is better known as "Dari" or "Derry Corn," used for feeding poultry. The imports in 1913 amounted to 389,844 centals, chiefly from United States, Turkey in Asia, British India and Egypt. In other years substantial supplies have also come from Java, Persia, Japan, Cape of Good Hope, East Africa Protectorate and Natal. As forage the plants in countries which admit of full development may be used cut green, as hay, as ensilage or as pasture, and though the roughage at harvest time from all the varieties may have a secondary use as forage, the sweet-stemmed kinds (see *S. Caffrorum* and *S. saccharatum*) are usually preferred for this purpose. In England during the past few years experiments made in Essex go to show that Sorghum may prove a useful addition to the forage crops in the warmer parts. It is recommended to be cut green and fed in the same way as "Maize" (*Zea Mays*), valuable for dairy cows in late summer when the pastures begin to fail (Journ. Bd. Agric. seq.). Some uncertainty attaches to the genus as a fodder, and cases of poisoning have been recorded when pastured or used in a green state. There seems to be considerable difference of opinion as to the exact stage at which there is danger of poisoning; but it is generally conceded that the green plant is not safe for feeding until it is at or near the flowering period.*

1. 1897, "Sorghum Sugar," pp. 173-174.

2. May, 1915, "Sorghum," pp. 155-166.

3a. No. 53, 1916, "Sorghum for Fodder."

Sorghum sudanense, Stapf (*Andropogon Sorghum*, var. *sudanensis*, Piper); Sudan Grass.

Annual, with slender stems, 6 to 10 ft. high, native of the Sudan in the region of the Nile. Cultivated in Egypt and the United States for forage—suitable for hay and pasture and as a soiling crop—for which purpose it is better adapted than the Grain Sorghums. The plant suits dry regions better than "Johnson Grass" (see *S. halepense*), and comes to maturity quickly—about 3 months. The young plants are stated to withstand slight frosts without injury, the northern limit for maturity being estimated at about 49° (Piper), and it is suggested here that this would be the best sorghum with which to experiment in England. There appears to be no record available as to the poisonous effects of the young green plant on stock; but it would be advisable to exercise the same care as recommended above.

Amphilophis pertusa, Stapf (*Andropogon pertusus*, Willd.); Sour Grass.

Perennial, 1½ to 2 ft. Tropical Africa and found also in Arabia, Afghanistan, India and Ceylon; introduced to

* See "Cyanogenesis in Plants," part 2 "Great Millet" (*Sorghum vulgare*), Dunstan and Henry in Trans. Royal Soc. exc. 1902, p. 399, and Proc. Roy. Soc. lxx. 1902, pp. 153-154, and "The Poisonous Properties of Immature Sorghum" in Bull. Imp. Inst. 1910, pp. 384-388.

Mauritius and Jamaica. An important fodder plant in the plains of Northern India, grown as pasture and for hay.

Other grasses that have been included under the term "Sour Grass" and referred to as *Andropogon pertusus* are **Amphilophis feracidulus**, Stapf (*Andropogon ischaemum*, var. *americanus*, Hack.) of Antigua, Dominica and Montserrat; **Amphilophis intermedia**, Stapf (*Andropogon intermedia*, R.Br.) of Australia and **Amphilophis intermedia**, Stapf (?) var. *acidula*, Stapf (*Andropogon pertusus*, Stapf in *Kew Bull.* 1895, p. 209) of Barbados, Nevis and Guiana, and also known from the Gold Coast and Angola. They are all perennial plants and of some value as forage.

1. 1895 "Sour Grass (*Andropogon pertusus*)," pp. 209-210.

Phalaris bulbosa, Linn.; Toowoomba Canary Grass.

Perennial, 4 ft. high, native of the Mediterranean region, Portugal, Mesopotamia, &c., introduced to Australia and South Africa as a promising fodder plant.

1. 1909, "*Phalaris commutata*," pp. 79-80, and "Toowoomba Canary Grass," pp. 289-292.

Phalaris canariensis, Linn.; Canary Grass.

Annual, 2 to 4 ft., native of Southern Europe; introduced to California, Argentine, Holland, &c. Imports of the seed into this country are chiefly from Turkey, Argentine, Spain, Portugal and Holland. In England the plant is recorded as being cultivated nearly a hundred years ago in the Isle of Thanet (Loudon, *Encycl. Pl.*) and Syme (*Eng. Bot.*) in 1872 refers to the "occasional cultivation in the southern counties, whilst town refuse has aided its spread in waste places and about gardens." Seed largely used for feeding birds, especially canaries.

"Reed Canary Grass" (*Phalaris arundinacea*, Linn.) a perennial 4 to 6 ft. high, native of the northern temperate regions; found near rivers and lakes and in ditches in Britain. It is recorded of this grass in Britain, "though the foliage is rather coarse it is relished by cattle and horses, and would probably answer well on wet land"; in the Northern United States, "furnishes an excellent quality of wild hay" (Hitchcock) and "the hay is palatable if cut young" (Piper).

Phalaris intermedia, Bosc. (*P. caroliniana*, Walt.), a perennial plant, cultivated to a limited extent in the Southern United States for winter forage (Hitchcock).

Anthoxanthum odoratum, Linn.; Sweet Scented Vernal Grass.

Perennial, 1 to 2 ft., native of Europe, Northern Asia, North Africa, &c.; wild and cultivated in Britain; introduced to North America. Grown in mixed pastures and for hay, which the fragrance due to the cumarin content is said to improve, though some difference of opinion seems to exist in reference to its value in this respect. Both Sutton and Hunter refer to the seed as being scarce and costly, and the latter mentions that an annual continental species (*A. Puelii*, Lecoq & Lamotte) a common weed and valueless for pastures is commonly sold for it.

Alopecurus pratensis, Linn.; Meadow Foxtail.

Perennial, 3 ft., of northern temperate regions; introduced to New Zealand. Common in meadows and pastures everywhere; grown largely in permanent pastures and for hay, especially in Northern Europe. Commercial supplies of seed for cultivation in Britain come chiefly from Holland, Sweden, Southern Russia, Finland, &c.

2. June 1909, "Meadow Foxtail," pp. 193-198.

Phleum pratense, Linn.; Timothy Grass, Meadow Catstail.

Perennial, 1 to 3 ft., native of Europe and northern temperate regions. Although a European grass its value under cultivation was first realised in America, from whence it was introduced to England by Timothy Hansen (hence the popular name) about 1780 (Loudon). It is a most important hay and pasture plant in Britain and in America—the area here exceeding all other perennial grasses in the "blue grass" region (see p. 30, under *Poa pratensis*): Commercial seed is grown in America, including Canada and on the Continent.

Agrostis alba, Linn.; Redtop, Fiorin, Bent Grass, Fine Top Grass.

Perennial 1 to 4 ft. Temperate regions, where, in Europe, America, &c., it is one of the standard crops for permanent pastures and for hay. The var. **stolonifera**, is also known as "Fiorin" and "Creeping Bent Grass," also commonly grown in pastures.

Trisetum flavescens, Beauv. (*Avena flavescens*, Linn.): Yellow Oat Grass, Golden Oat Grass.

Perennial 1 to 2 ft. Europe, Asia and North Africa, and to some extent in America, grown for hay and in mixed pastures.

Avena sativa, Linn.; Oat.

Annual. Cultivated in many varieties. Imports of the grain are chiefly from Argentina (7169904), Germany (3832976), Russia (3118976), Canada (2629760), United States (1606096), Chile (924672), Roumania (682640), New Zealand (108976), Netherlands (105392), Turkey in Asia (43904), Turkey in Europe (2240), Australia (7952), and British South Africa (but no returns 1913). The production in the United Kingdom for the same year (1913) amounted to 62,807,248 centals or more than three times the amount imported. An important food as oatmeal and "rolled oats" and fodder—crushed grain and straw for horses, and the plant before maturity is sometimes cut for forage. "Sussex Ground Oats" are specially recommended for rearing and fattening poultry.

2. June 1898, "The Oats Supply of the United Kingdom," pp. 25-28; June, 1903, "Experiments in the Growth of Oats," pp. 53-56; July, 1904, "Effect of bad weather on the Vitality of Oats," pp. 217-219; July, 1905, "Experiments with Varieties of Oats," pp. 219-221; Oct., 1906, "Sussex Ground Oats," pp.

429-431; August, 1907, "The Milling Properties of Oats," pp. 257-268; Dec., 1914, "Substitutes for Oats in Feeding Farm Horses," pp. 808-811; May, 1915, "The Identification of the Country of Origin of Commercial Samples of Oats," pp. 165-166; May, 1916, *ibid.*, pp. 105-116, and tables i.-iii.; Feb., 1917, "Varieties of Oats and Barley," pp. 1056-1063; June, 1916, "Silage made from Oats and Tares as a Food for Milking Cows," pp. 224-229.

3a. No. 19, 1914, "Substitutes for Oats in Feeding Farm Horses." No. 36, 1915, "Winter Oats."

Arrhenatherum avenaceum, Beauv. (*Avena elatius*, Beauv.); Tall Oat Grass, Tall Meadow Oat Grass, False Oat Grass, French Rye Grass.

Perennial, 2 to 4 ft. Europe; cultivated in Sweden, France, Switzerland, and Britain; also in the United States and Australia for hay and mixed pastures.

Cynodon Dactylon, Pers.; Bermuda Grass, Bahama Grass, Wire Grass (Virginia), Indian Couch, Doub, Dog's-tooth Grass.

Perennial, usually low-growing, 4 to 6 in., but sometimes up to 3 ft. (this height being given on a specimen from Somaliland in Herb. Kew). Cosmopolitan in hot countries and found in some temperate regions, including parts of the south of England. Grown in the West Indies, India, United States, Australia, &c., for pasture and for hay. In the West Indies the underground rhizomes are also used for feeding animals. In the United States it is stated to be "the most important perennial grass in the South, filling much the same position in respect to pasturage as 'Kentucky Blue Grass' (see *Poa pratensis*) in the North." Recommended in combination with *Lespedeza* (see p. 8); "good Bermuda pastures will carry one cow to the acre, and the best Bermuda and *Lespedeza* mixed pastures will support two cattle to the acre during the summer," and "compared with Timothy (see p. 28) as a hay feed for work mules of equal value" (Piper). On specimens in the Herbarium at Kew this grass is noted as being used for feeding stock in British East Africa, Somaliland, Rhodesia, Unyoro and Mossamedes.

1. 1894, pp. 377-378.

Chloris Gayana, Kunth; Rhodes Grass.

Perennial, native of Tropical Africa; introduced to Australia, Montserrat, Porto Rico, the Southern United States, &c. A useful fodder plant for stock. Grown as a meadow grass in the Southern United States (Hitchcock).

Chloris tenella, Roxb., is mentioned as good fodder in India (Watt) and in Somaliland (Appleton, Herb. Kew).

Eleusine coracana, Gaertn.; Ragi (India), Ginger Millet, Tamba (N. Nigeria).

Annual, 2 to 5 ft.; cultivated in India and Africa as a cereal, a particular feature of which appears to be the cheapness of the grain, and although a staple food in some parts, it is sometimes

only regarded as a famine food. In India the straw is used for fodder, and Lunt on a specimen in the Kew Herbarium notes that it is cultivated in the Hadramaut (vernac. "Dokhn") as "food for cattle."

Cynosurus cristatus, *Linn.*; Crested Dog's-tail Grass.

Perennial, 1 to 2 ft. Europe; commonly cultivated in meadows and pastures, especially valuable in sheep-runs (see also "Hard Fescue," p. 31, and "Sheep's Fescue," p. 31). Sutton recommends it for Deer Parks.

Eragrostis abyssinica, *Schrad.*; Teff, Theff or Thaff (Abyssinia).

Annual, 2 to 4 ft., native of Abyssinia; distributed from Kew to various British Possessions in 1886 (seed obtained from Abyssinia), including India, Australia, Natal, British Guiana, and later also to California and the Transvaal. Everywhere it seems to have met with conspicuous success as a valuable hay and pasture grass, suitable for all kinds of stock. The seed is used in the country of origin for making bread.

1. Jan. 1887, "Teff," pp. 2-6; 1894, pp. 378-380; 1913, pp. 32-39.

Dactylis glomerata, *Linn.*; Cock's-foot Grass, Rough Cock's-foot Grass, Orchard Grass.

Perennial, 2 to 3 ft., native of Europe and widely distributed in temperate regions, extending to New Zealand, where it has become the commonest grazing grass. Cultivated in all countries in pastures and for hay; but for this purpose recommended to be cut early as the stems at maturity get hard and woody.

Poa nemoralis, *Linn.*; Hudson's Bay or Evergreen Meadow Grass, Wood Meadow Grass.

Perennial, 1 to 2 ft., of the temperate regions of Europe and Asia and in North America. A well-known pasture grass often used also for lawns in shady places. Sutton states that "the seed is too costly and the supply too uncertain to warrant a large use of it in ordinary grass land." Commercial seed has been largely collected from wild plants in Germany.

Poa pratensis, *Linn.*; Smooth-stalked Meadow Grass, Kentucky Blue Grass, Blue Grass, June Grass.

Perennial, 1 to 2 ft., of the northern temperate regions; introduced to New Zealand. Cultivated in Europe, North America, &c., for pasture, suitable for all kinds of stock. In America it is "second among grasses in total value only to "Timothy" (see *Phleum pratense*) in the region of which "all the best pastures are wholly or primarily Blue Grass" (Piper).

Poa trivialis, *Linn.*; Rough-stalked Meadow Grass.

Perennial, 1 to 2 ft., of the northern temperate regions; meadows and pastures of the mountainous districts of Europe, with a good rainfall. Of lesser importance in America than the foregoing.

The genus is an important one for meadow grass and as of secondary importance to the above may be mentioned "Canada," "Virginia," or "Flatstone" Blue Grass (*Poa compressa*, Linn.), native of Northern Europe; "Texas Blue Grass" (*Poa arachnifera*, Torr.), native of North America; "Fowl Meadow Grass" (*P. serotina*, Ehrh.), of the northern temperate regions and "Tussock Grass" (*P. flabellata*, Hook., *Dactylis caespitosa*, Forst.), a native of the Falkland Islands, introduced to Britain in 1842 as a fodder plant with success only in the West of Scotland.

Glyceria aquatica, Wahlenb. (*Poa aquatica*, Linn.); Water Meadow or Sweet Reed Grass.

Perennial, upwards of 6 ft. high, growing in low-lying and sometimes flooded ground in the northern temperate regions. Common in the Fen districts of Cambridgeshire and Lincolnshire where it is an important fodder plant, cut green in summer and as hay for winter.

"Floating Sweet Grass" (*Glyceria fluitans*, Br.), a semi-aquatic perennial, common in Britain and on the Continent. The grain is used as food in Germany, Holland, Poland and Russia.

Festuca arundinacea, Schreb. (*F. elatior*, Linn. sub-sp. *arundinacea*, Hack.); Tall Fescue.

Perennial, 3 to 6 ft. (Sutton), 3 to 5 ft. (Armstrong). Europe, North Africa, grown for hay and pasture. Seed for England was chiefly produced in the Rhenish Provinces, and it is now practically unobtainable (Hunter). Sutton distinguishes the continental plant as *F. elatior*, var. *fertilis*, Sinclair, the English grown seed not being considered reliable for fertility.

"Reed Fescue" (*F. littoralis*, Br.), a native of New Zealand, is sometimes sold for "Tall Fescue," but it is not recommended on account of its coarse, reedy nature (Hunter, Armstrong).

Festuca duriuscula, Linn. (*F. ovina*, Linn. var. *duriuscula*, Koch.); Hard Fescue.

Perennial, 1 ft. and upwards. Europe; commonly in hilly districts, of importance in sheep pastures, and for permanent grass lands.

Festuca heterophylla, Lam. (*F. rubra*, Linn. sub-sp. *heterophylla*, Hack.); Various-leaved Fescue.

Perennial, 3 ft. Europe; cultivated in Britain for permanent pastures.

Festuca ovina, Linn.; Sheep's Fescue.

Perennial, 6 ins. or so in height. Europe; common in pastures, especially for sheep; N. Europe—Russia, Highlands of Scotland, &c., and in Siberia. A var. *tenuifolia* is known as "Fine-leaved Fescue."

Festuca pratensis, Huds. (*F. elatior*, Linn. sub-sp. *pratensis*, Hack.); Meadow Fescue.

Perennial, $1\frac{1}{2}$ to 3 ft. Europe and N. Asia; recommended in Britain for hay and permanent pastures. Commercial seed is imported from Denmark and the United States (Hunter). "Meadow Fescue" is "of small importance in American agriculture, except in Eastern Kansas, where much seed is grown principally for export to Europe" (Piper).

***Festuca rubra*, Linn.;** Red Fescue, Creeping Fescue.

Perennial, 1 to 2 ft. Northern temperate and arctic regions, New Zealand, &c. In Europe grown in meadows and pastures and recommended where hares are preserved. In North America, though wild, it does not appear to be much cultivated for forage. Both Sutton and Hunter indicate difficulty in obtaining seeds of this grass, and the latter recommends a variety called "Chewing's Fescue" from New Zealand. Armstrong (*seq.* p. 151) identifies this variety with *F. rubra*, var. *fallax*, Hack. [*F. fallax*, Thuill., found in all Europe except Russia and the Balkans], and mentions that it is not "of much agricultural value in Britain"; but Piper (*seq.* p. 227) states that for all practical purposes "Chewing's Fescue" is identical with the European Red Fescue.

***Bromus inermis*, Leyss.;** Brome Grass, Awnless Brome Grass, Hungarian Forage Grass.

Perennial, 1 to 3 ft., native of North Europe, Caucasus region, Siberia, and found in the Western Himalaya. An important fodder grass in Germany and Hungary; grown also in Britain and North America; suitable for all kinds of stock.

***Bromus unioloides*, H. B. & K. (*B. Schraderi*, Kunth);** Fescue Grass, Schrader's Brome Grass, Australian Brome.

Annual or biennial, 2 to 4 ft. high, native of South America - Argentine; cultivated in the Southern United States for winter forage (Hitchcock), and Australia, where practically all the commercial seed is grown (Piper), and to a small extent in England.

"Chess or Cheat" (*Bromus secalinus*, Linn.), native of Europe, Mediterranean region, N. Asia, &c., a common weed in wheat fields, is cultivated for hay in Oregon and Washington (Hitchcock), in North Georgia under the name of "Arctic Grass." "produces good crops of hay which liverymen consider equal to "Timothy," especially if it be cut while the seeds are in the dough stage" (*idem*).

"Erect, Upright or Meadow Brome" (*B. erectus*, Huds.), is a perennial species, 3 ft. high, native of Temperate Europe and Asia and found in Algeria; cultivated in Southern France for forage.

***Lolium perenne*, Linn.;** Perennial Rye Grass, Red Darnel.

Perennial, 1 to 2 ft. Europe, Temperate Asia and North Africa; cultivated in New Zealand. One of the oldest and best known grasses for permanent pastures and rotation in Europe. Commercial supplies of seed grown largely in Scotland and Ireland.

2. May, 1904, "Use of Rye Grass in Seed Mixtures," pp. 105-106; Oct. 1904, "Perennial and Italian Rye Grass," pp. 418-419.

Lolium multiflorum, Lam. (*L. italicum*, A. Br.); Italian Rye Grass.

Annual or biennial, 2 to 4 ft. Europe, and also cultivated in New Zealand, Argentine, &c. Recommended as a pasture grass and for hay in alternate husbandry; and has been found very successful grown alone under irrigation in connection with sewage farms. Commercial seed grown in the countries above-mentioned and also produced in the North of Ireland.

2. April, 1915, "Suggestions for the Cultivation of Catch Crops and Home-Grown Feeding Stuff," p. 25.

3a. No. 28, 1916, *ibid.*, p. 3.

Secale cereale, Linn.; Rye.

Annual. Cultivated under several varieties in Northern Europe, Central Europe and N. America, the imports coming chiefly from Russia (493954), United States (234651), Canada (192987), Germany (77067), Roumania (15680), and cultivated also in France and England as a green fodder crop and for the grain used like wheat for making bread, though for this purpose in England it is not so much in favour because of the dark colour of the flour. The grain is amongst other grasses the commonest matrix of "Ergot" (*Claviceps purpurea*, Tul.) and in countries where rye bread is a staple food, the people are subject to "Ergotism," a disease which ultimately paralyses the lower limbs.*

2. March, 1909, "Production of Hand Thrashed Rye Straw in France," pp. 926-927; Oct., 1917, "Grain Crop," pp. 731-733.

3a. No. 28, 1916, "Suggestions for the Cultivation of Catch Crops and Home-Grown Feeding Stuff," p. 3.

Triticum sativum, Lam.; Common Wheat.

Annual. Cultivated in many varieties, including "Flint Wheats" (*T. durum*, Desf.), "Rivet Wheats" (*T. turgidum*, Linn.), &c. Grain imported chiefly from the United States (38156097), Canada (24402448), British India (21018032), Argentine (16526944), Australia (11341857), Russia (5612432), Chile (856912), Germany (501312), New Zealand (62944), Roumania (43232), Turkey in Europe (39984), Turkey in Asia (5936), Persia (11200), Netherlands (1792), Belgium, Bulgaria and Uruguay (no imports in 1913 from the last three countries). The United Kingdom produced in the same year (1913) approximately 34,017,840 centals.

The entire dependence on this familiar cereal for bread and the use of the milling residue as bran, &c., for feeding stock, gives it first place as a foodstuff in the Order, and it is, perhaps, equalled only by rice in the whole series under review. The Flint varieties are largely used in Southern Europe, Italy especially, for making Vermicelli, Macaroni and Semolina.

* See "Plants Poisonous to Live Stock," H. B. Long (1917), pp. 88-91, for particulars of this poisonous fungus.

***Hordeum vulgare*, Linn.; Barley.**

Annual. Cultivated in many varieties; grain imported chiefly from Russia (6837600), United States (4970672), British India (4053728), Canada (2869216), Turkey in Asia (2500176), Turkey in Europe (5376), Roumania (1555456), Denmark (582512), Germany (399392), Tunis (390544), Argentine (296464), Austria Hungary (298816), Algeria (138768), Chile (93184), France (45920), Cyprus (29568), Persia (28784), Belgium (4368), Australia (3248), Mexico (2352), and Morocco, the United Kingdom producing in the same year (1913) 32,816,264 centals.

The varieties of four-rowed, also known as "Bere" or "Bigg," are sometimes grown for green forage, but the grain is principally used for making beer and whiskey, the dried grains from the breweries and distilleries being used for feeding stock and for the same purpose the "malt culms" (the rootlets and shoots developed when germinating the grain for conversion into malt) are also used. The prepared grain as "Pot" and "Pearl" barleys is well-known as food.

***Arundinaria Maling*, Gamble; Maling Bamboo.**

Culms upwards of 15 ft., native of Sikkim; commonly cut as forage for ponies in the neighbourhood of Darjeeling.

***Bambusa arundinacea*, Willd.; the Spiny Bamboo.**

A tall, graceful grass, 80 to 100 ft. high, wild and cultivated in India and Burma. "The seeds, which somewhat resemble wheat, are edible, and have in certain years proved of great value in supplementing food supplies, more especially since flowering very frequently accompanies seasons of famine or scarcity"; "the young shoots are eaten and somewhat resemble asparagus; the leaves are very largely employed as fodder, more especially for buffaloes and elephants" (Watt).

***Melocanna bambusoides*, Trin.; Terai Bamboo, Berry-bearing Bamboo.**

A tall, strong grass, 50 to 70 ft. high, of Eastern Bengal and Burma. It is remarkable for its large edible fruit, which occasionally germinates before separating from the stem.

The "Male Bamboo" (*Dendrocalamus strictus*, Nees) with culms 20 to 100 ft. high, common throughout India and Burma, yields a food grain, and many more Bamboos might be mentioned as useful for fodder or food; but the young shoots of probably all are eaten more or less for food in India and on the rare occasions when the plants do flower and fruit, the grain of many species appears to be of value.

1. 1889. "Food Grains of India—*Dendrocalamus strictus*," pp. 283-284; 1907, "The Flowering of Cultivated Bamboos," pp. 228-233; 1912, "The Arundinarias of the Hills of Sikkim," pp. 135-140.

The imports of Grass seeds probably all for use in Agriculture are given under "Clover and Grass" Seed, and the two are entered here for convenience (see *Trifolium*, p. 6). The total imported in 1913 amounted approximately to 264,799 centals,

chiefly from France, United States, Germany, Denmark, Chile, Argentine, Russia, Holland, Belgium, Italy, Austria-Hungary.

The production from 6,770,173 acres in England and Wales in the same year was for "Hay from Clover, Sainfoin and Grasses under rotation," 60,683,123 centals, and for "Hay from Permanent Grass" or "Meadow Hay," 142,088,889.

Many more grasses of value, though more or less only of local importance, and often only substitutes for better plants, might be enumerated. To mention one or two examples of this kind we have "Rice Grass," "Sea Rice," or "Sedge" (*Spartina alterniflora*, Loisel), a grass used primarily for mud-binding; but which is cut regularly for fodder in the neighbourhood of Southampton (see K.B. 1907, p. 194); "Marram Grass" (*Ammophila arundinacea*, Host.), a sand-binding plant common on the sandy shores of Britain, introduced to Victoria in 1883. originally for sand-binding; but which has since been found of value also for fodder in the localities where it has been established (l. c. 1897, pp. 211-217; 1913, p. 364) and "Spire Reed" or "Common Reed" (*Phragmites communis*, Trin.), common in marsh-lands in Britain, the young tops of which have been recommended for feeding stock in hard times (see Sp. Leaflet, No. 34, 1915, "Autumn & Winter Fodder," pp. 2-3). But, for these and for further information on those already mentioned, the following works may be referred to:—

Kew Bulletin.—"Tropical Fodder Grasses," 1894, pp. 373-387; 1895, pp. 209-211; 1896, pp. 115-118. "The Grasses of British Somaliland," 1907, pp. 203-228. "Australian Grasses," 1908, pp. 21-29. "Economic Notes on Transvaal Grasses," 1911, pp. 158-161.

"A List of the Grasses of North Western India: Indigenous and Cultivated," J. F. Duthie, pp. 1-47 (Roorkee 1883).

"Illustrations of the Indigenous Fodder Grasses of the Plains of North Western India," *idem*, Part i., Plates i.-xl. (Roorkee, 1886), Part ii., Plates xli.-lxxx. (Roorkee, 1887).

"A Census of the Grasses of New South Wales," F. Turner. pp. 1-57 (Govt. Printer, Sydney, 1890).

"Australian Grasses," *idem*, vol. i., pp. i.-xxxviii and 1-58 (Govt. Printer, Sydney, 1895).

"The True Grasses," E. Hackel; translated from "Die Natürlichen Pflanzenfamilien," by F. Lamson-Scribner & E. A. Southworth, pp. 1-228 (Constable & Co., Westminster, 1896).

"Economic Grasses," F. Lamson-Scribner, U.S. Dept. of Agric. Div. of Agrostology, Bull. No. 14, 1898, pp. 1-85.

"A Manual of the Grasses of New South Wales," J. H. Maiden, pp. 1-199, illustrated, with notes of "Value as Fodder" (Govt. Printer, Sydney, 1898).

"The Chief Species, Races, and Varieties of European Cereals," J. Percival, pp. 1-12, illustrated by 28 sheets of dried specimens (Headley Bros., Kent and London, 1902).

"Literature on the Races of Rice in India," Agricultural Ledger, No. 1, 1910, pp. 1-334; Second half, pp. 335-594 (Calcutta, 1910 & 1911).

"The Corn Crops: A Discussion of Maize, Kafirs, and Sorghums as grown in the United States and Canada," E. G.

Montgomery, pp. 1-347, illustrated (The Macmillan Company, New York, 1913).

"Native Pasture Grasses of the United States," D. Griffiths, L. Bidwell & C. E. Goodrich, U.S. Dept. of Agric. Bull. No. 201, 1915, pp. 1-52, Plates i.-ix.

"A Textbook of Grasses: With Especial Reference to the Economic Species of the United States," A. S. Hitchcock, pp. 1-276, illustrated (The Macmillan Company, New York, 1914).

"The Small Grains," M. A. Carleton, pp. 1-699, illustrated (The Macmillan Company, New York, 1916)—all Grasses excepting "Buckwheat" (*Fagopyrum esculentum*, Moench) included in chapter xxii., pp. 581-599.

"British Grasses and Their Employment in Agriculture," S. F. Armstrong, pp. 1-199, illustrated (Cambridge University Press, 1917).

CRUCIFERAE.

***Brassica campestris*, Linn., var. *chinensis*.** Chinese Cabbage, Shantung Cabbage, Peh-tsai (China).

Annual. China, India—a garden crop. A correspondent of "The Garden" (Nov. 18, 1893) who had grown this cabbage in England, regarded it as worthless boiled as a vegetable, but of great value and excellent as a late autumn salad—"white, crisp, and sharp as the best summer cos lettuce." In China the Shantung cabbage is grown everywhere but attains its greatest perfection in the colder parts; it is the favourite variety amongst the half dozen other varieties cultivated, eaten fresh or preserved by salting and drying in the sun; the Chinese prefer their own varieties to the common European cabbage also widely cultivated there; but the same author considers that "from a European standpoint no variety of Chinese Cabbage is worth growing being so very inferior in flavour to our own."—(Wilson, "A Naturalist in W. China," ii. (1913) p. 56).

The Shantung Cabbage was grown at Kew in 1888 from seed sent by the Commissioner of Customs at Chefoo and seeds ripened at Kew were distributed to correspondents interested in new vegetables. Enquiries recently made show that interest in the plant seems to be reviving.

1. 1888; pp. 137-138; 1893, p. 344.

***Brassica campestris*, Linn. var. *oleifera*;** European Colza.

Annual or biennial, 2 to 3 ft. high. Europe—France, Belgium, &c. (see European Rape for imports to United Kingdom). Cultivated for seed and green fodder. "A Pirou (Manche) le 16 Mai, 1833, généralement cultivé dans le pays comme plante oleifere ce font les graines qui fournissent l'huile" is an interesting statement on an old specimen in the Kew Herbarium. "Colza has been grown to some extent in Essex and Lincolnshire, but is less in favour with English farmers than the rape, though producing more seed" (Johnson & Sowerby). Most of the Economic literature on this plant appears to be more or less involved with that of "Rape" (*B. Napus*, Linn., var. *oleifera*) (q. v.) and indeed for general purposes it may be regarded as the same.

Brassica campestris, Linn. var. **Sarson**; Indian Colza, Sarson (India).

Annual, 4 to 5 ft. high. India—a cold season crop. Oil from the seed used in India for cooking. See “Indian Rape” for imports of seed.

1. 1894, pp. 96-97. “Guzerat Rape” (*B. campestris*, var. *glauca*).

Brassica juncea, Hook. f. & Thoms. (*B. Besseriana*, Andrez.) Indian Mustard, Rai (India).

Annual, 3 to 6 ft. (Prain) $2\frac{1}{2}$ to 10 ft. (Rep. Agric. Res. Inst. Pusa, 1914-15, p. 41). India—a field crop, but on a smaller scale than “Rape” (Watt); cultivated in Sarepta, Astrakhan—Volga River, and other parts of Southern Russia, Abyssinia, Angola (Fl. Trop. Afr.). Oil from the seed used for food in India and Russia, the green plant for cattle fodder and young leaves as a vegetable in India. It is probable that this mustard is used with that of *B. alba* and *B. nigra* in preparations for table use.

Brassica Napus, Linn. var. **dichotoma**; Indian Rape, Tori (India), Summer Rape (Europe).

Annual, 1 to 4 ft. India (395287)—a field crop on the plains in the cold season, on the Himalayas in the spring (Watt); Europe—a summer crop. Oil from the seed used as food and green plant for cattle fodder in India. Oil in this country classed with “Colza”—chief use for burning and lubricating, but sometimes when refined for food; cake an important cattle feed. It would seem that the seeds of this plant are often crushed with those of *B. juncea*, the Indian Mustard. Some samples of cake were recently submitted to Kew and found to contain seed coats of both plants; the cake was strongly suspected of having been the death of a number of cows, the cause obviously being due to the high percentage of mustard seed residue in it—similar trouble is referred to in Kew Bulletin, 1894, p. 96, at which time it was stated the matter had often been investigated at Kew, and the advice given that “Rape cake used for feeding should be free from any seed containing Mustard oil.” It is, moreover, difficult if not impossible to separate the trade particulars of “Rape,” “Mustard,” and “Colza” seed from India, and the figures given must therefore refer more or less to all three. The seed goes under the names of “Brown Cawnpore,” “Yellow Cawnpore,” “Yellow Guzerat,” “Ferozepore,” “Jamba” (see *Eruca sativa*), &c., and the oil as “Brown East Indian,” “Jamba,” &c. A sample of so-called “Bombay Brown Mustard” seed submitted to Kew for identification was found on cultivation to belong to the variety under consideration, and samples of this and of *B. juncea* have been received under the description of “Mustard seed from India.”

Brassica Napus, Linn. var. **oleifera**; European Rape.

Annual or biennial, 2 to 4 ft. Russia (489048 seed), Germany (14406 seed, 34473 oil), Netherlands (7845 seed, 20227 oil), Belgium (8992 seed, 42201 oil), France (8198 oil), Great Britain,

Canada, United States—cooler parts. Rape seed is well-known for feeding cage-birds and poultry. Oil expressed from the seed when refined used as food, but its chief use usually under the name "Colza" is for burning and lubricating; cake used for feeding cattle. In the last three mentioned countries the green plant is grown chiefly for forage, as a soiling crop for steers or young stock, the pasturing of hogs and sheep, and also recommended for ensilage. Rape, amongst other plants, is advised in Bd. of Agric. Special Leaflet, No. 30, 1915, for pig-feeding, both as a pasturing and soiling crop. The variety grown for forage is chiefly "Dwarf Essex," and in all probability the names "Broad-leaved Dwarf Essex," "Broad-leaf Winter Rape," "Giant," &c., are synonymous.

2. May, 1917, "Rape Pastures," pp. 182-187.

3a. No. 28, 1916, "Rape," p. 4; "Rye and Rape mixed," p. 5.

Brassica alba, *Hook. f. & Thoms.*, White Mustard. **B. nigra**, *Koch.*; Black or Brown Mustard. European Mustard, Grocer's Mustard.

Annuals, 1 to 4 ft. France—Alsace (Vilmorin) and Southern Europe, Germany, Holland, Asia Minor, Abyssinia (Fl. Trop. Afr.); England—Eastern Counties near the Fens and bordering the Wash, more particularly "Black"; the "White" is grown chiefly in Essex and Cambridge. The powdered seeds of the two species are used in the preparation of table mustard, usually husked before grinding in England, ground whole in France, the flour made from the whole seed being the more pungent of the two. "Charlock" (*Brassica Sinapistrum*, Boiss.) seeds are sometimes used as a substitute for those of the true mustard, and possibly also those of *B. juncea*. The following decision of the Board of Food and Drug Inspection of the United States Dept. of Agriculture in reference to this form of adulteration was noted in the Board of Trade Journal, Oct. 12, 1911:—"It is the opinion of the Board that when charlock is substituted in part for mustard the label should clearly indicate this fact. A condiment prepared from mustard or mustard flour and charlock with salt, spices and vinegar is not "Prepared Mustard," but, provided a greater quantity of mustard than of charlock is used, it should be called 'Prepared Mustard and Charlock.'"

The White Mustard is commonly grown for salad and as green fodder for sheep.

2. Dec. 1896, "Cultivation of Mustard in England," p. 301. Feb. 1916, "The Growing of Mustard Seed," pp. 1134-1136.

3a. No. 28, 1916, "White Mustard" p. 4; No. 58, 1916, "White Mustard."

Brassica rugosa, *Prain*; Cabbage Mustard, Chinese Cabbage Mustard, Chinese Cabbage-leaved Mustard.

Annual, 4 to 6 ft. China, India—a cold weather crop in West, Central and East Himalaya (Watt). Cultivated as a vegetable and for the sake of the oil obtained from the seeds.

Eruca sativa, *Linn.*; "Brassica Substitute," Rocket, Jamba (India).

Annual, 6 in. to 1½ ft., S. Europe, N. Africa, Hadramaut (Arabia), India (*see* imports under "European Rape"—exported from Karachi under the name of "Jamba," commonly grown with barley, gram, peas or cotton as a substitute for "Sarson" or "Rape"; oil from the seed used for food, but mainly as an illuminant, cake for feeding cattle and green plant for fodder (Watt). Young leaves eaten as salad in France (Vilmorin); cultivated at Katan, Hadramaut, where the roots are used as salad (Kew Bull. 1894, p. 328).

Camelina sativa, *Crantz.*; Yellow Dodder, False Flax, Gold of Pleasure.

Annual, 2 to 3 ft. high. A common weed in this country, the United States, Canada, &c.; cultivated to a limited extent in Southern Russia. Oil from the seed used in Central Europe for a variety of domestic purposes. Cake as a feeding stuff for cattle uncertain; plant sometimes grown as green fodder for sheep; seeds liked by birds, especially finch and bunting; poultry and geese particularly are very fond of the seeds and fatten quickly upon them (Johnson & Sowerby). An analysis of "Gold of Pleasure Cake (Camelina)" shows water 10.25, oil 11.2, albuminoids 35.37, digestible carbohydrates 25.64, woody fibre 11.53, mineral matters 6.01, sand and silica 0.8 (Smetham).

Cochlearia Armoracia, *Linn.*; Horse Radish.

Perennial. Belgium, Holland, Germany, Great Britain—a garden crop, the trade relying on supplies from the aforementioned countries. Nearly half a century ago it was recorded ("The Garden," Dec. 16, 1876, p. 576) that "It is somewhat remarkable that a crop so easily grown as Horse Radish should be sufficiently remunerative to pay for importation whilst in the London market-gardens comparatively little of it is grown," and enquiries made by Kew at Covent Garden recently show that similar conditions prevail in this country to-day, when the cultivation might still more be worthy of some extension.

2. March, 1890, "Cultivation of Horse Radish in Bohemia," pp. 493-494.

Other plants in Cruciferae that may be noted are the well-known "Cabbage" (*Brassica oleracea*, *Linn.* var. *capitata*), "Kale" or "Borecole" (*B. o.* var. *acephala*), "Savoy" and "Brussels Sprout" (*B. o.* var. *bullata*), "Cauliflower" and "Broccoli" (*B. o.* var. *Botrytis*), "Kohl-rabi," "Siam Cabbage" or "Hungarian Turnip" (*B. o.* var. *caulo-rapa*), "Turnip" (*B. campestris*, *Linn.* var. *esculenta*), "Swede Turnip" (*B. c.* var. *napo-brassicata*), "Cress" (*Lepidium sativum*, *Linn.*), "Water Cress" (*Nasturtium officinale*, *R. Br.*), "Sea Kale," (*Crambe maritima*, *Linn.*), all grown on a field or market-garden scale.

Journal of the Board of Agriculture:—"Storing Turnips," Oct. 1904, pp. 398-401; "The Value of the Turnip as a Vegetable and Stock Food," April, 1916, pp. 66-67. "The Cultivation of Water Cress," Feb. 1909, pp. 826-834; March, 1915.

pp. 1093-1098. "Experiments as to the Quality of Swedes," Aug. 1906, pp. 282-288. "Cultivation of Sea Kale," March, 1914, pp. 1088-1090. Board of Agriculture Leaflet, No. 153, 1905, "Storing Turnips."

"Water Cress: Its History and Cultivation." W. W. Glenny in Journ. Roy. Agric. Soc. viii. (1897), pp. 607-622.

"Mustard: A note on the Mustards Cultivated in Bengal," D. Prain, Bull. No. 4, 1898 (Reprinted from Agric. Series, No. 3, Dept. of Land Records & Agric., Bengal), pp. 1-78.

"*Brassica* spp. (Mustard): On the seeds of some species of *Brassica* & *Sinapis*, with reference especially to those of India," W. Kinzel (Transl. from Die Landw. Versuchs-Stationen, vol. 52, pp. 169-193) in Agric. Ledger, No. 7, 1901, pp. 103-127. pls. i.-ii.

"The Seed Coats of Certain species of *Brassica*," A. J. Pieters & Vera K. Charles, U.S. Dept. of Agric. Div. of Botany, Bull. No. 29, 1901, pp. 1-19, pl. i. ff. 1-6.

"Rape as a Forage Crop," A. S. Hitchcock, U.S. Dept. of Agric., Farmer's Bull. No. 164, 1903, pp. 1-16.

"*Brassica*" in Comm. Products of India, G. Watt (1908), pp. 174-186.

"Production and Utilisation of Rape Seed," in Bull. Imp. Inst. xiii., 1915, pp. 452-460.

"Rape (*Colza*, Ravison, Tori) and Mustard Seed" (Indian Trade in Oil-seeds), in Bull. Imp. Inst. xv., 1917, pp. 380-389.

ROSACEAE.

***Prunus Amygdalus*, Stokes, var. *dulcis*; Sweet Almond.**

A small tree; cultivated in the Mediterranean region—Southern Spain, France, Sicily, &c., in the Canary Islands, and California, for the kernels used for dessert. The best known in commerce are "Jordan" and "Valencia" Almonds, and supplies generally come chiefly from Spain (74944), Morocco (41913), Italy (22245), Portugal (14277), Canary Islands (5865). France (5529), Turkey in Asia (938), &c., to a total of 176,733 centals in 1913. The returns would probably include a proportion of "Bitter Almonds" (var. *amara*, Stokes), especially from Morocco (Mogador); these kernels cannot be eaten, as they contain prussic acid, their chief use is for the extraction of an oil used for flavouring liqueurs and in cookery. There are varieties of the Almond tree grown in gardens in Great Britain that also have eatable sweet kernels.

***Prunus Avium*, Linn.; Sweet Cherry. *Prunus Cerasus*, Linn.; Sour Cherry, Morello Cherry.**

These are trees of good size in their wild state, and from them have been obtained the many excellent varieties that are now cultivated in orchards and gardens in most countries with a temperate climate, including Europe, North America, North Asia, Australia, Tasmania, New Zealand, &c. The Trade supplies of the fresh fruit in England (with an acreage of over 10,000 acres in 1917) were augmented in 1913 from France (31585), Holland (22726), Belgium (14434), Germany (993), &c., to a total of 69,739 centals.

2. June, 1917, "Investigations and Experimental Work carried on in Cherry Orchards in Kent," pp. 288-298.

***Prunus Armeniaca*, Linn.; Apricot.**

A deciduous tree, probably native of China; naturalized in Afghanistan, Kashmir, &c.; grown in several varieties in gardens of Europe, North West India, China, Tibet, North America, &c., chiefly as wall fruits in the warmer parts. For Foreign and Colonial sources of fresh fruits see under "Peach" (*P. Persica*), and for dried fruits under "Prune" (*P. domestica*, var. *juliana*). Dried Apricot fruits are an important food in North West India, and pressed Apricot pulp is sold in bazaars in Damascus (Specimens in Museum, Kew).

***Prunus Persica*, Stokes; Peach (velvety skinned), Nectarine (smooth-skinned).**

A deciduous tree, probably native of China. There are many varieties cultivated in temperate parts of Asia, Europe, America, &c., under glass or as wall fruits and in orchards in warmer climates. Fresh fruits are commonly sold in the markets of England, both home-grown and foreign; though always more or less of a luxury, and in America the Peach appears to be the most important commercially of all the stone fruits. Trade supplies of the fresh fruit into this country come chiefly from France, United States, Cape of Good Hope, &c., totalling in 1913, 10,653 centals; the returns also include Apricots.

2. Feb. 1908, "The Pruning of the Peach," pp. 661-669.

***Prunus communis*, Huds. (*P. domestica*, Linn.); Plum.**

A small deciduous tree of Temperate Europe, Asia, America, &c. It includes many fine varieties and also the Damson and the Greengage. In addition to a good home trade, the imports of fresh plums have been chiefly from Germany, France, Holland, Belgium, Italy and United States, in 1913 amounting to 459,062 centals. Greengages also come from Spain, and see also under the following variety.

***Prunus communis*, Linn. var. *juliana*, (*P. domestica*, var. *juliana*, DC.); Prune, Prunier de St. Julien, French Plum.**

A deciduous tree of temperate climates, largely grown in Central Europe—notably the Servian Valley, in France—Department of Lot and Garonne, from whence it has been introduced to California, where the drying of the fruit is an important industry. There are several good varieties grown, but the principal one exported from Servia and France is "Prune d'Ente," and from California "Petite Prune d'Agen." "Italian Prune" and "d'Agen" are also grown in the States of North West America. The common French Plum used for stewing is "Prune St. Antoine." The imports into this country are included under "Fruit dried or otherwise preserved without sugar," together with "Plums," "Prunelloes," "Greengages," "Damsons," "Mirabelles," and "Apricots," coming chiefly from the United States (168013), France (18841)

Germany (17611), Austria-Hungary (10464), Canada (3822), Servia (1392), Holland, Italy, and Australia, in all amounting (1913) to 221,440 centals.

The "Quetsche" or "Quetschen" (*P. communis*, Huđs., var. *pruneauliana*; *P. oeconomica*, Borkh.) is an inferior kind of dried prune that was imported from Germany when French prunes were scarce.

1. 1890, "Production of Prunes in the South of France," pp. 263-269; 1892, "The Prune Industry of California," pp. 259-267, with plate of "Petite Prune d'Agen"; 1893, "Prune Cultivation in California," pp. 175-179.

2. June, 1901, "The Preparation of Prunes or French Plums," pp. 75-77; March, 1902, "Prune Growing in the United States," pp. 530-531.

The "Japanese Apricot" or "Mume Plum" (*P. Mume*, Sieb. & Zucc.), the "Japanese Plum" (*P. triflora*, Roxb.) of China and Japan, and the "Myrobalan" or "Cherry Plum" (*P. cerasifera*, Ehrh.), all have edible fruits of good quality, sometimes imported. The "Sloe" or "Blackthorn" (*P. spinosa*, Linn.), is best known for its use in the preparation of sloe gin. The salted flowers of *Prunus Pseudocerasus*, Lindl., are used as food in Japan.

Rubus Idaeus, Linn.; Raspberry.

A deciduous shrub about 5 ft. high, of Europe, Western Asia, &c., of which there are several varieties cultivated. The "Loganberry" is a hybrid between the "Raspberry" and a "Blackberry."

2. June, 1896, "Cultivation and Evaporation of Raspberries in the United States," pp. 54-59; Nov. 1906, "Cultivation of Raspberries," p. 497; Oct. 1910, "The Commercial Cultivation of the Loganberry," pp. 552-556, illustrated.

Included in the genus are the common "Blackberries" *Rubus fruticosus*, Linn., and *R. saxatilis*, Linn., of the hedgerows and *R. laciniatus*, Willd., of garden origin, the "Cloudberry" (*R. Chamaemorus*, Linn.), the "Dewberry" (*R. caesius*, Linn.); the "Native Red Raspberry" (*R. strigosus*, Michx.), of Canada: improved kinds are the "Lowberry" and an American hybrid "Wilson Junior Blackberry," and several "Himalayan Rubi," including *R. ellipticus*, Smith, introduced to Queensland and Jamaica; *R. racemosus*, Roxb., introduced to Jamaica, and *R. rosaefolius*, Smith, introduced to Martinique and Dominica, are referred to (*K.B.* 1895, pp. 123-124) as yielding edible fruits.

Fragaria vesca, Linn.; Strawberry.

Perennial; cultivated in many temperate countries. The home trade in the fresh fruit is augmented from France (15864), Holland (979), and a comparatively small import from the Channel Islands (about 2 centals in the same year (1913) and 13 centals in 1912).

2. July, 1907, "Modern Strawberry Growing," pp. 193-205; June, 1909, "Strawberry Growing in Hampshire," pp. 186-193.

3. No. 207, 1913, "Strawberry Cultivation."

***Pyrus communis*, Linn.; Pear.**

A deciduous tree of Europe and Western Asia. There are many varieties under cultivation,* and supplies of the fresh fruit have come from United States (277105), Belgium (269507), France (87886), Holland (73927), Canada (40110), Australia (28826), Germany, Cape of Good Hope and Channel Islands to a total of 805,199 centals for the year 1913. In addition to the use of this fruit for eating, the manufacture of "Perry" is of special importance in the counties of Gloucestershire, Worcestershire, Herefordshire and Monmouthshire.

2. Dec. 1903, "Cold Storage of Pears," pp. 398-401; March, 1909, "Varieties of Pears," pp. 940-941.

***Pyrus Malus*, Linn.; Apple.**

A deciduous tree, widely distributed in temperate countries, including Europe, Western Asia, America, Australia, &c. and like the pear there are many varieties† under cultivation in Europe, Western Asia, America and Australia. Supplies of fresh fruit come chiefly from the United States (1552880), Canada (1415929), Australia, Holland, France, Belgium, Germany and Channel Islands to a total of 3,648,309 centals, the United States and Canada contributing each well over a million centals and therefore the largest share. The manufacture of cider is of importance in the counties of Devonshire, Cornwall, Herefordshire, Worcestershire, Somersetshire, Dorsetshire, Gloucestershire, Monmouthshire and Shropshire and also in Normandy. The Pomace is recommended for feeding stock.

The fruits of the cultivated forms of the "Crab Apple" (*P. Malus*, Linn.), the "Siberian Crab" (*P. baccata*, Linn.), and the "Mountain Ash" (*P. Aucuparia*, Gaertn.) are used for making jelly. The "Medlar" (*P. germanica*, Hook. f.) of Europe and Asia has a fruit unfit to eat in the fresh state, but is edible after being "bletted," in which condition it is commonly used.

2. Dec. 1904, "Utilisation of Cider Apples for Cattle Feeding," pp. 549-560; August 1917, "The Value of Cider Apples and Pomace as Food for Farm Stock," pp. 530-531; Oct. 1908, "Competition in Apple Growing," pp. 487-494, and numerous Papers on kindred subjects.

3. No. 134, 1905, "Apple Culture"; No. 211, 1908, "Cider Orchards"; No. 283, 1915, "Storage and Disposal of Apples and Pears."

***Eriobotrya japonica*, Lindl.; Loquat, Japanese Medlar.**

A small tree about 15 ft. high of China and Japan. Cultivated in Northern India, Southern France, Malta, Canary

* A Catalogue-Index of the known Varieties referred to in American Publications, from 1804 to 1907, of the United States Dept. of Agriculture (Bur. Pl. Industry, Bull. No. 126, 1908) covers 268 pages.

† A similar work of the Dept. (Bull. No. 56, 1905) in reference to Apples, 1804 to 1904, covers 395 pages.

See also *Kew Bull.* Nov. 1887, pp. 5-13, Canadian Apples and Pears.

Islands and other warm temperate or sub-tropical countries. A dessert fruit. The "Loquat" has been known in gardens of England for at least a century; Loudon (Encycl. Pl.) states that "to ripen it with flavour it requires the temperature of the stove, and comes into use in March."

Amongst other plants in the Order may be mentioned "Salad Burnet" (*Poterium Sanguisorba*, Linn.), a plant common on chalk downs and dry hills in England; recommended in mixtures for permanent pastures. "Quince" (*Cydonia vulgaris*, Pers.), "Japanese Quince" (*Cydonia japonica*, Thunb., and *C. Maulei*, T. Moore) (see *K.B.*, 1917, p. 339) used for making marmalade and jelly. The "June Berry" (*Amelanchier canadensis*, Medic.), sometimes used in North America for cakes and preserves. "Saskatoon Berry" (*Amelanchier alnifolia*, Nutt.) of Manitoba and North West Territories, fruits used fresh and preserved by settlers and Indians. The "Coco or Cocoa Plum" (*Chrysobalanus Icaco*, Linn.) of Tropical America, West Indies, and West Africa; fruit in the West Indies eaten fresh or preserved, and in Angola after being dried. The "Mola" or "Mobola" Plum (*Parinarium Mobola*, Oliv.), the "Ginger Bread Plum" (*P. macrophyllum*, Sabine) and *Parinarium curatellaefolium*, Planch.) of Tropical Africa, with edible fruits. The "Mexican Hawthorn" (*Crataegus pubescens*, H.B.K.) of Mexico, fruits edible and made into various kinds of preserves (*K.B.*, 1914, pp. 289-298). "Ghazalor" (*Crataegus Azarolus*, Linn.) of Malta and the Orient: fruits edible.

It is convenient to consider here **Saxifrageae**, which, though an extensive Order, contains only the "Gooseberry" and "Currant" of interest as fruits, usually classed with *Rosaceae* in "Small" or "Orchard" fruits.

Ribes Grossularia, Linn.; Gooseberry.

A shrub common in the Northern Hemisphere, where it is found wild in the North West Himalaya, Caucasus, Mountains of Greece, &c. There are numerous varieties under cultivation. In England this fruit is always looked forward to at Whitsun. Kent, Worcestershire and Middlesex are common centres of supply to the London Market. Supplies of "Raw Gooseberries" also come from Holland (4924), Belgium (3646), France (474) in all for 1913, 9,056 centals.

It is remarkable that "the wild gooseberry of the Himalaya produces a small, hairy, very sour fruit which is most unpalatable, and is hardly ever eaten even by the natives"; but, on the other hand, the fruit of the wild variety of "Black Currant" is said to be "very like that of the cultivated black currant, and quite as large and very palatable" (Watt). The "Wild Black Currants" (*Ribes Hudsonianum*, Rich., & *R. americanum*, Mill.) of North West Canada are also highly esteemed for their fruit (*K.B.* Nov. 1887, p. 16), and also the "Wild Smooth Gooseberry" (*R. oxycanthoides*, Linn.) of Canada is said to have a small fruit of good flavour (*l.c.* p. 18). The last-mentioned is the parent of the American Garden Gooseberries.

Ribes nigrum, *Linn.*; Black Currant. **R. rubrum**, *Linn.*; Red Currant and **R. rubrum**, *Linn.*, var. **album**, *Desf.*; White Currant.

Small shrubs of Northern Europe and Northern Asia, Johnson & Sowerby (Useful Pl. Gt. Britain) record Britain as a native country of *nigrum* and probably also of *rubrum*.

Several varieties of the Red and Black are under cultivation. Supplies of the fresh fruit from abroad have come chiefly from Holland (56465), France (49296), Germany and Belgium, totalling in 1913, 121,734 centals.

The following references, as bearing generally on these two Orders, may be of interest:—

Journal of the Board of Agriculture:—"English Orchards," June, 1898, pp. 1-10, Sept. 1898, pp. 145-151, Dec., 1898, pp. 319-325. "Fruit Preservation," June, 1901, pp. 61-63. "Planting Fruit Trees and Bushes," Nov. 1904, pp. 449-458. "Training and Pruning Fruit Trees and Bushes," Dec. 1904, pp. 522-528. "Preparation of Fruit Pulp in France," Jan. 1905, pp. 621-624. "Drying or Evaporating Fruit," March, 1906, pp. 756-759. "Pruning Fruit Trees," March, 1908, pp. 705-711; April, 1908, pp. 22-30. "Notes on the Time of Blossoming of Fruit Trees," Dec. 1908, pp. 678-686; April, 1910, pp. 32-38; "Root-Pruning Fruit Trees," July, 1909, pp. 290-293. "Small Fruit Growing in Kent," Nov. 1909, pp. 628-635. "Fruit Farming in West Kent," Jan. 1911, pp. 811-815. "Fruit Bottling," March, 1911, pp. 977-981. "Fruit Preserving for Small Market Growers or for Domestic Use," Aug. 1915, pp. 447-450. "The Making of Fruit Pulp," pp. 450-453.

Board of Agric. Leaflet, No. 148, 1908, "Planting Fruit Trees and Bushes." No. 162, 1915, "Grafting Fruit Trees." No. 70, 1916, "The Treatment of Neglected Orchards." Special Leaflet No. 5, 1914, "Fruit Preserving for Small Market Growers or for Domestic Use." No. 31, 1917, "The Making of Fruit Pulp."

"The Apples of New York," S. H. Beach, N. O. Book, & O. M. Taylor, vol. i. pp. 1-409, vol. ii. pp. 1-360 (J. B. Lyon Co., Albany, New York, 1905); illustrated with coloured plates.

"The Plums of New York," U. P. Hedrick, pp. 1-616 (1911).

"The Cherries of New York," *idem*, pp. 1-371 (1915).

"The Peaches of New York," *idem*, pp. 1-541 (1917); all illustrated by coloured plates (J. B. Lyon Co., Albany, New York).

"British Apples: Report of the Committee of the National Apple Congress," A. F. Barron, 5 plates (London, 1884).

"Pears: Report of the Committee of the National Pear Conference," *idem*, in Journ. Roy. Hort. Soc. ix. 1887, pp. 1-230.

"Apple and Pear Conference, 1888" in Journ. Roy. Hort. Soc. x. 1888, pp. 1-376, with descriptive catalogue of Apples exhibited and statistical and other information relating to the cultivation of Apples in Great Britain and Ireland.

"Conference on Fruit Growing" in Journ. Roy. Hort. Soc. xxx. 1906, pp. 1-166, with a Table of the Acreage under Fruit

Cultivation in England, Wales, and Scotland, and Map showing acreage of fruit in each County.

"Bush Fruits: A Horticultural Monograph of Raspberries, Dewberries, Currants, Gooseberries, and other shrub-like Fruits," F. W. Card, pp. 1-537; illustrated (New York, 1907).

"Apples and Pears," by G. Bunyard, pp. 1-116, illustrated, col. plates (T. C. & E. C. Jack, London & Edinburgh).

"A Guide to the Literature of Pomology," E. A. Bunyard in Journ. Roy. Hort. Soc. xl. 1914-15, pp. 414-449.

ANONACEAE.

Anona Cherimolia, Mill.; Cherimoyer.

A small tree, 10 to 15 ft. high, native of the Andes of Ecuador and Peru; cultivated for the fruit in various sub-tropical countries.

Anona muricata, Linn.; Soursop.

A small tree, about 10 ft. high, of the West Indies, Tropical America and Africa and other tropical countries; fruit commonly sold in the native markets.

Anona reticulata, Linn.; Custard Apple, Bullock's Heart.

A small tree, upwards of 20 ft., native of Tropical America and West Indies; cultivated in India, Africa, &c., for the fruit.

Anona squamosa, Linn.; Sweet Sop, Sugar Apple, Custard Apple (India).

A small tree, upwards of 20 ft., native of South America and the West Indies; cultivated in India, Africa, &c., for the fruit.

These fruits are practically unknown in this country—though "Custard Apple" has been noted on sale in Liverpool (K.B. 1908, p. 189)—as they are not suitable for shipment; but in the countries of production they are of importance. The original form of the generic name was "*Annona*," which implies means of subsistence.

1. Aug. 1887, "Cherimoyer," pp. 15-16.

1a. ix. 1 (1908) "*Anona*," pp. 47-49.

CAPPARIDAE.

Capparis spinosa, Linn.; Caper.

A scrambling shrub, native of the Mediterranean region. Cultivated in France, Spain, Algeria, Italy, Sicily, &c., whence the floral buds, well known as "Capers," are imported into this country, shipped chiefly from Marseilles and Bordeaux, those from Roquevaire in France being the most important.

The "Queensland Pomegranate" (*Capparis Mitchellii*, Lindl.) has an edible fruit. Recently several enquiries have been made at Kew as to the suitability of the fruits of the "Caper Spurge" (*Euphorbia Lathyris*, Linn.), a common weed in this country for pickling in the same way as the ordinary Caper; but being more or less poisonous they cannot be recommended as a substitute.

1. 1898, "Caper Industry in France," pp. 31-32.

2. Sept. 1897. "The Caper Industry of Roquevaire," pp. 221-223.

GUTTIFFERAE.

Garcinia Mangostana, Linn.; Mangosteen.

A small tree, 20 to 30 ft. high, native of the Malay Peninsula; cultivated in Ceylon, parts of India, and the West Indies. One of the choicest of tropical fruits, regularly shipped from Singapore to Calcutta; but so far attempts to introduce this fruit to the European markets have not been successful, beyond the fact that they have been favourably reported on after travelling from Trinidad (1897), where the first West Indian Fruits were produced in 1875. In Jamaica the Mangosteen fruited for the first time in 1886, the plants in both instances being distributed from Kew. The fruit of the "Wild Mangosteen" (*G. indica*, Chois.) is eaten in India.

1. 1898, "Mangosteens from the West Indies," pp. 26-27.

1a. ix. 1 (1908) pp. 64-65.

The Order includes the "Butter & Tallow Tree" (*Pentadesma butyracea*, Don.), a tree of West Africa; yields a fat from the seeds used by the natives of Sierra Leone for cooking, and the "Mammee Apple" (*Mammea americana*, Linn.), a large tree of the West Indies, with an edible fruit.

TERNSTROEMIACEAE.

Caryocar nuciferum, Linn., **C. tomentosum**, Willd.; Souari Nuts, Butter Nuts.

Large trees, native of South America. The kernels are valued as dessert nuts. A large supply of nuts of *C. nuciferum* was received at Kew in 1891 from the Botanical Gardens, Demerara, and distributed to various Colonial Gardens (*K.B.* 1891, p. 277; 1892, p. 75).

Camellia Thea, Link. (*Thea chinensis*, Sims); Tea.

A shrub, probably native of Assam and China. Cultivated principally in British India (2034593), Ceylon (1109364), Java (216744), and China (161632), the figures stated being the share of each country out of a total importation in 1913 of 3,650,434 centals. The British Possessions contributed out of this amount 3,147,627 centals, in addition to the first two mentioned above, they were South Africa, Nyasaland, Straits Settlements, Hong Kong, Australia, Canada, and the West Indies. The foreign countries contributing the remainder of 502,807 centals were, including Java and China, chiefly United States, Japan, Russia, Argentine, &c. Various blends of tea are sold, but broadly they are classed as "China," "Ceylon," and "Indian." "Canton Scented Orange Peko" and "Gunpowder" green tea are special kinds supplied for flavouring. There is in the Museum at Kew a very full series of the teas of commerce.

1. 1888, "Jamaica and Natal Tea," pp. 86-88; 1889, "Puerh Tea," pp. 118-120; 1890, "Compressed or Tablet Tea," pp. 109-112; 1892, "Lao Tea," pp. 219-222; 1892, "Mauritius Tea," pp. 234-238; 1895, "Tea Cultivation in the Caucasus," pp. 58-61; 1896, "Leppett Tea," pp. 10-16; "White Tea of Persia," pp. 157-158.

MALVACEÆ.

Hibiscus esculentus, *Linn.*; Ochro (W. Africa & W. Indies), Edible Hibiscus, Lady's Fingers.

A shrub, native of India; distributed to Tropical Africa and naturalized in all tropical and many sub-tropical countries. The young pods are used everywhere as a vegetable. In India the mature fruits are used to make curry and the leaves are recommended as cattle fodder.

1a. ix. 1 (1908) pp. 71-72.

Hibiscus Sabdariffa, *Linn.*; Rozelle, Red Sorrel, Indian Sorrel.

A shrub cultivated in Tropical Africa and most tropical countries. The fleshy calyces are made into a preserve, the leaves are used as a pot-herb, and the seeds are a good food for cattle.

1a. ix. 1 (1908), p. 74.

Gossypium spp.; Cotton Seed.

Annuals or perennial plants grown as annuals, widely cultivated in tropical and sub-tropical countries for the cotton fibre, and most if not all of the countries export or utilise the seed. It yields on crushing a yellow oil, which when refined may be used in the manufacture of oleo-margarine, as a salad oil, and as a substitute for olive oil. When bleached it is used in the preparation of a substitute for lard. The cake made from the seeds after the expression of the oil is a valuable feeding material for cattle, as also is the meal mixed with the hulls. Cotton seed is imported from Egypt, United States, West Indies, British India, East and West Africa, Uganda, Peru, Brazil, Colombia, Russia, China, Turkey, &c., and in 1913 the amount was 13,783,436 centals. Cotton Seed Cake—5,302,595 centals from Germany, France, Austria-Hungary, Egypt, Turkey in Asia, United States, Mexico, Peru, Brazil, British East Indies, &c., and Cotton Seed Oil, refined and unrefined—395,494 centals, the greater proportion (356406) being imported in the same year from the United States.

1a. ix. 1 (1908), "*Gossypium*," pp. 76-85.

2. Sept. 1898, "Effects on Butter of Cotton Seed and Sesame Seed Oil Cake," pp. 205-208; June, 1901, "Feeding Value of Cotton Cake and Cotton Seed Meal," pp. 41-43.

The seeds of "Kapok" (*Eriodendron anfractuosum*, DC.) yield an edible oil, and the cake made from the residue is said to compare very favourably with ordinary cotton seed cake for feeding cattle.

The "Durian" (*Durio Zibethinus*, *Linn.*), a tree of Malacca and the Malay Islands, is considered one of the finest of tropical fruits, provided the taste is acquired and the objectionable flavour and odour is first overcome.

STERCULIACEÆ.

Theobroma Cacao, *Linn.*; Cocoa or Cacao.

A tree, 20 ft. and upwards, native of Tropical America; cultivated in many tropical countries. Raw cocoa is imported from

British West Africa (203246), British West Indies (160336), Brazil (128966), Ecuador (89230), Ceylon (50511), Togoland and Cameroons (15777), Venezuela (7261), Java (6238), Costa Rica (5370), British Honduras, Seychelles, British Guiana, &c., in all for 1913, 783,595 centals. The uses of the bean in the preparation of chocolate and as a beverage are well known, and "Cocoa Butter" is also an important food product, Holland supplying in 1913—19,326 centals, smaller quantities coming from Germany, United States and Brazil.

Experiments in Denmark and Germany in the feeding of horses and cattle with the shells and cake residues from cocoa manufacture show them to be poisonous and therefore not to be recommended.

1. 1890, "Cacao Cultivation in Ceylon," pp. 170-173; 1893, *ibid.* Grenada pp. 136-139; 1895, *ibid.* "Gold Coast," pp. 13, 22; 1899, "Cacao in Ecuador," pp. 42-45.

1a. ix. 1 (1908), pp. 96-104.

2. Aug. 1916, "The Poisonous Properties of Cacao Shells," p. 498.

The "Kola Nut" (*Cola acuminata*, Schott & Endl.), a tree native of West Africa, is used chiefly as a stimulant, but the nut forms an important item socially and dietetically in the daily life of the West African native. In Europe preparations of the nut are said to be efficient substitutes for tea or coffee.

1. 1890, pp. 253-260; 1906, pp. 89-91.

1a. ix. 1 (1908), pp. 91-95.

LINEAE.

Linum usitatissimum, Linn.; Flax, Linseed.

Annual, $1\frac{1}{2}$ to 3 ft. high; cultivated in many temperate countries. The seed is used for the extraction of oil for various industrial purposes, and the residual cake is an important feeding stuff for cattle; though it appears to have, at times, been the cause of poisoning. The occasions when this has happened, however, seem to be rare, due probably to the fact that the cake is usually fed as part of a mixed ration.

The imports of Linseed come chiefly from Argentine (4687762), Canada (5314953), British India (2841063), Russia (412867), United States (178614), Holland (56522), Belgium (22152), Uruguay, China, Morocco, Turkey, &c., to the amount in 1913 of 13,620,098 centals. Linseed cake imported in the same year amounted to 1,874,409 centals.

1. 1913, "Flax (Fibre & Seed)," pp. 319-335.

2. Dec., 1896, "The Antwerp Linseed Trade," p. 320; Jan., 1906, "Supply of Linseed Cake in the United Kingdom," pp. 610-613; Feb., 1911, "The Formation of Hydrocyanic Acid from Linseed Cake," pp. 904-907; April, 1912, "Growth of Linseed for Feeding Purposes," pp. 30-33; Sept., 1912, "The Formation of Prussic Acid from Linseed Cake and other Feeding Stuffs," pp. 446-460; Nov., 1912, "Hydrocyanic Acid from Linseed Cake," pp. 657-660; Aug., 1913, "The Growing of Linseed for Feeding Purposes," pp. 377-385; May, 1915, "The Feeding

of Linseed to Calves," pp. 120-121; May, 1918, p. 217; Feb., 1916, "Linseed as a Farm Crop," pp. 1069-1080.

3. No. 278, 1913, "The Growing of Linseed for Feeding Purposes."

RUTACEAE.

Citrus Aurantium, Linn.; Sweet Orange. **C. Aurantium**, Linn. var. **Bigaradia**; Bitter or Seville Orange. **C. decumana**, Murr.; Shaddock, Pumelo or Pomelo, Grape Fruit. **C. Medica**, Linn.; Citron. **C. Medica**, var. **acida**; Lime. **C. Medica** var. **limonum**; Lemon.

Small trees of tropical and sub-tropical countries, the Shaddock and the Lime being perhaps more suited to tropical, and the Orange, Lemon and Citron to sub-tropical conditions.

Oranges are imported chiefly from Spain (5624681), Portugal, Italy, Asiatic Turkey, Egypt, United States, Cape of Good Hope and British West Indies, over 5 to 6 million centals a year, Spain, as indicated in the figures above for 1913, supplying the greater share. Lemons, Limes and Citrons are classed together in the Customs Returns as coming from Germany, Spain (probably all Lemons and Citrons), Italy (Lemons chiefly), and British West Indies (probably all Limes) to the amount of over 700,000 centals a year. Other well-known *Citrus* fruits are "Blood" or "Maltese" Orange (*C. Aurantium* var. *melvotensis*), "Tangerine" (*C. Aurantium* var. *nobilis*) and "Kumquat" (*C. Aurantium* var. *japonica*).

1. 1894, "West Indian Lime," pp. 113-116; "Jaffa Orange," pp. 117-119. 1895, "Orange Growing in Florida and Jamaica," pp. 125-126; "Citrus Fruits in Sicily," pp. 266-271. 1900, "Metford's Lemon," pp. 28-29.

1a. ix. 1 (1908), "*Citrus*," pp. 122-136.

ILICINEAE.

Ilex paraguensis, St. Hil.; Paraguay Tea.

A shrub, native of Paraguay. Leaves infused like tea, used in South America, where it is an important product, and several million pounds are exported. "Paraguay tea is now advertised for sale in this country and appears to be in moderate demand, possibly as a curiosity more than as a regular article of food"—this statement was made in 1898, and it is probable that the same conditions hold good to-day.

1. 1892, pp. 132-137; 1898, pp. 142-143.

AMFELIDEAE.

Vitis vinifera, Linn.; Grape. **V. vinifera**, Linn. var. **corinthiaca**; Currant.

A vine, cultivated in Southern Europe, North Africa, South Africa, Canary Islands, Syria, United States, South America, Australia, &c., largely for the production of wine, of which the United Kingdom imported in 1913, 12,332,912 gallons., France, Portugal and Spain contributing more than 3,000,000 gallons each. Raisins to the amount of 826,728 centals were imported in the same year, the greater proportion coming from

Spain, Turkey in Asia, Greece and Australia; of Currants—1,459,142 centals were imported, Greece supplying no less than 1,452,543 centals of the whole; and of fresh Grapes, the home supply (grown under glass) was augmented in the same year from Spain (554548), Portugal (49330), Channel Islands (16264), Belgium (15121), Holland, Cape of Good Hope, &c., to a total of 652,441 centals.

1. 1888, "Cochin China Vine" (*Vitis Martini*, Planch.), pp. 134-135; 1889, "Vine Cultivation in the Gironde," pp. 227-230; 1894, "Viticulture in Malaga," pp. 34-36; 1897, "Wine Production in France," pp. 201-203.

SAPINDACEAE.

Acer saccharinum, *Wangh.*; Sugar Maple.

A tree upwards of 100 ft. high with a trunk 3 or 4 ft. in diam., native of the United States and Canada. The production of Maple Sugar and Syrup appears to be confined to the countries mentioned. The tree was introduced to England in 1735. Seeds specially obtained from Philadelphia were despatched from Kew to Kashmir about 20 years or so ago. The Sycamore (*Acer Pseudoplatanus*, Linn.), abundant in this country has long been known to yield sugar, but not in paying quantities, and only recently (1918) a correspondent of the Director of Kew made a fair trial with some trees on his estate; but finally gave it up as impracticable.

1. 1895, "Maple Sugar (*Acer saccharinum*)," pp. 127-128; 1911, "The Sugar Maple," pp. 303-304.

The fruits of "Horse Chestnut" (*Aesculus Hippocastanum*, Linn.) are said to be used in Switzerland and Turkey for feeding sheep, horses, &c. The fruits of "Litchis" (*Nephelium Litchi*, Camb.) and "Longans" (*N. Longana*, Camb.) of China and the East Indies are sometimes imported into this country for dessert.

"Akee Apple" (*Blighia sapida*, Koenig.), a tree of West Africa and West Indies, has the seeds set in a creamy white arillus which is edible, and when cooked forms a very palatable food; but unless quite fresh this is decidedly unwholesome and sometimes poisonous.

The fruits of the "Lac Tree" or "Kosumba" (*Schleichera trijuga*, Willd.), a large deciduous tree of India & Ceylon, are edible; the seeds in commerce are of greater value for the oil they yield; but "the jungle tribes in times of scarcity gather the fruits for their own consumption rather than for trade purposes" (Watt).

1. 1899, "Lungan Pulp," pp. 219-220.

1a. ix. 1 (1908) "*Blighia sapida*," pp. 167-168.

ANACARDIACEAE.

Pistacia vera, *Linn.*; Pistachio Nut.

A small tree of Syria, Mesopotamia and Persia; cultivated in Sicily and other parts of Southern Europe from whence they are imported into this country. Eaten in fig-cakes in Cyprus

and Greece, and in England sold by grocers for use like almonds or in confectionery.

1. 1890, "Pistachio Cultivation in Cyprus" and "at Aleppo" pp. 69-71.

Mangifera indica, Linn.; Mango.

A tree 50-60 ft. high, native of the East Indies and Malaya; naturalized in Tropical America, Asia and Africa. There are many choice varieties under cultivation. The fruits as well as being eaten fresh are used in large quantities in India in the manufacture of chutney, which comes into the English and American markets. Consignments of fresh fruits from Jamaica and India have been made with success; but no regular trade has been developed. Ripe mangoes preserved in syrup may be had in this country.

1a. ix. 1 (1908) pp. 169-175.

Anacardium occidentale, Linn.; Cashew Nut, Cashew Apple.

A small tree, indigenous to South America and the West Indies; introduced to Tropical Africa and many warm countries. The roasted kernels are commonly eaten as dessert, for which purpose they are exported from India to the United Kingdom and France. The juicy, fleshy pedicel may also be eaten when ripe, and from it may also be distilled a spirit which in some parts, notably Mozambique, Portuguese East Africa, is an important beverage.

1. 1898, "Cashew Spirit," pp. 28-29.

1a. ix. 1 (1908), pp. 175-176.

In this Order mention may also be made of the "Golden Apple" or "Otaheite Apple" (*Spondias dulcis*, Willd.), a tree from 50 to 60 ft. high of the Society Islands and Fiji Islands, and "Purple Spanish Plum" (*S. purpurea*, Linn.) of the West Indies, with edible fruits.

MYRTACEAE.

Psidium Guayava, Linn.; Guava.

A small tree, native of Tropical America; naturalized in many tropical countries.

The fruit is well known as one of the best of tropical fruits, eaten fresh and largely used in the West Indies for making jelly. The fresh fruits, because of their tendency to decay quickly when ripe do not come into the markets of this country; but it is possible to obtain various forms of preserves, "Guava Jelly," "Guava Cheese," &c., that are supplied chiefly from the West Indies.

The "Purple-fruited Guava" or "Chinese Guava" (*P. Cattleianum*, Sabine), a small tree native of Brazil, grown in China, &c., has a fruit which is said to be superior to the foregoing.

1a. ix. 2 (1911) pp. 315-316.

Eugenia caryophyllata, Thunb.; Clove.

An evergreen tree, 30 to 40 ft. high, native of the Moluccas,

cultivated in Java, India, West Indies, Zanzibar, Pemba, &c.

The flower buds are the cloves of commerce, of which Zanzibar and Pemba probably supply the greater part. Under "Species Unenumerated" the Customs Returns give for 1913, 44,849 centals from these islands out of a total from all sources of 88,818 centals.

1. 1893, "Clove Industry of Zanzibar," pp. 17-20.

1a. ix. 2 (1911) pp. 318-319.

The "Rose Apple" (*Eugenia Jambos*, Linn.), a tree 20 to 30 ft. high, and the "Malay Apple" (*E. malaccensis*, Linn.), a shrub 6 to 8 ft., natives of Tropical Asia, East Indies, &c., and the "Pitanga Cherry" (*E. uniflora*, Linn.) of Brazil, all have edible fruits.

Pimenta officinalis, Lindley; Allspice, Pimento, Jamaica Pepper.

A tree 20 to 30 ft. high, native of the West Indies, extending to Central America and under cultivation in many tropical countries. The dried unripe fruits are used as a spice, Jamaica being the principal source of supply to this country.

1a. ix. 2 (1911) pp. 317-318.

Bertholletia excelsa, H. & B.; Brazil Nut.

A large tree of the Amazon region; introduced to the Botanic Gardens of Ceylon (1880), Singapore (1881), and Brisbane (1885) from the Royal Gardens, Kew, to Jamaica (1881), and Trinidad (prior to 1862—nuts exhibited at the Inter. Exhib. London, 1862) from the mainland, where specimen trees can now be seen in fruit yearly.

Lecythis Ollaria, Linn., and **L. Zabucajo**, Aubl.; Sapucaia Nuts.

Large trees of Brazil and Guiana. Similar efforts have been made to introduce the "Sapucaia" nut trees to other countries, but so far apparently without success, no record being available of trees having grown to maturity. In Trinidad, perhaps the best Colony in which to expect success, it is stated (Bull. Dept. Agric., Trinidad & Tobago, part 1, 1918, p. 27) in reference to *Lecythis Zabucajo*, "No fruiting trees are known in the Colony. A short time ago seed was obtained and plants of it raised in the St. Clair Nurseries, for distribution. Some of these have made good growth in wet districts. At Port of Spain they failed." "Brazil" and "Sapucaia" nuts are imported into the United Kingdom from the native countries mentioned and are well known for their use as dessert nuts.

1. Dec., 1887, "Introduction of the Brazil Nut to the East Indies and Australia," pp. 11-13.

The fruits of *Napoleona imperialis*, Beauv., a shrubby tree of West Africa, are eaten by the natives.

LYTHRARIÆ.

Punica granatum, Linn.; Pomegranate.

A small tree, native of Southern Europe and Western Asia; largely cultivated in the Tropics and Sub-tropics. The fruit

is one of the oldest known—since 1491 B.C. (Smith); it is commonly imported into this country, though not in large quantities.

1a. ix. 2 (1911) pp. 323-324.

ONAGRARIÆ.

Trapa bispinosa, *Rōxb.*; Singhara Nut.

An aquatic plant of Tropical Africa, India and Ceylon. The nuts are an important food in Kashmir, India, Tropical East Africa—Lukugu River, Zambesi River, &c., West Africa—Yola, cultivated in lakes, pools and tanks.

Trapa natans, *Linn.*; Water Chestnut, Jesuit's Nut, Water Caltrops, Gnar Nuts, Ling (China).

An aquatic plant, widely distributed in Central Europe, Temperate Asia, and in Africa—Upper Nile and Victoria Nyanza regions. The seed is farinaceous and may be eaten raw, roasted, or in soups, an important food in the countries where grown.

1a. ix. 2 (1911) "*Trapa*," pp. 324-325.

PASSIFLOREÆ.

Passiflora edulis, *Sims*; Purple-fruited Passion Flower, Mountain Sweet Cup. **P. laurifolia**, *Linn.*; Bell Apple. **P. quadrangularis**, *Linn.*; Granadilla.

Climbing plants, native of Tropical America, commonly cultivated in the Tropics and warm countries. Edible fruits, those of the Granadilla being usually sold in the Paris markets and occasionally in the London markets.

1a. ix. 2 (1911) "*Passiflora*," pp. 325-327.

Carica Papaya, *Linn.*; Papaw, Melon Tree.

A small tree, 15 to 20 ft. high, commonly cultivated in the Tropics, often self-sown on rubbish heaps and odd corners in the neighbourhood of native dwellings and farms. The fruits may be eaten when ripe as dessert, cooked when young and green as a vegetable, or pickled in the green state.

1a. ix. 2 (1911) pp. 327-329.

CUCURBITACEÆ.

Cucumis Melo, *Linn.*; Melon, Sweet Melon, Musk Melon, Nutmeg or Netted Melon, Cantaloup.

Native probably of Bokhara; cultivated in many warm countries and well known as a dessert fruit. In Afghanistan, where Melons are largely cultivated as a field crop, the "Sarda Melon" is exported to India, and it has been recommended for importation into this country for use in the winter, the full flavour being developed on keeping for a time after exposure to a low temperature. Two fruits were sent to the Director, Kew, by Dr. Aitchison from Kabul, and the report on them was that "they arrived at the beginning of January (1894) in excellent condition, carefully packed in cotton wool; the flesh, though firmer than that of the melons ordinarily cultivated in

this country, amply justified in flavour the reputation which this fine fruit enjoys throughout India." Fruit grown at the Royal Gardens, Frogmore, from seeds distributed by Kew, was described as "10 in. long, 7 in. diam., skin yellowish green and netted, the wall of flesh 2 in. thick, and rich in flavour as well as sweet and juicy."

1. 1894, "Sarda Melon," pp. 75-76.

Cucumis sativus, *Linn.*; Cucumber.

Well known in gardens everywhere; used green for salads and pickles. The early season trade for the market gardeners at home has been reduced in importance by the development of shipments from Holland. There appears to be a good trade in pickled fruits of "Gherkins" or "Concombre de Russie" (Vilmorin) from Russia and "Boston Pickling" or "Green Prolific" from America, which seems to pay better than the fresh fruits.

Citrullus vulgaris, *Schrad.*; Water Melon, Canadian Citron, Citron Water Melon.

Climbing annual, widely distributed in warm countries. The fruit is well known for its watery, refreshing pulp when ripe, and as a vegetable when green. Large supplies of Water-melons in normal times come into the markets of this country from Spain and Portugal.

Cucurbita Pepo, *DC.*; Pumpkin, Vegetable Marrow (sometimes distinguished as var. *ovifera*).

Climbing annuals, cultivated in many hot countries and in temperate countries during the summer months. Pumpkins and Vegetable Marrows are well known as vegetables, and Pumpkins are good food for pigs and cattle, and are also recommended for sheep. The seeds cracked small are recommended for feeding poultry.

The fruits of the "Calabash Gourd" or "Melon Pumpkin" (*C. maxima*, Duchesne) and the "Portmanteau Gourd" or "Naples Gourd" (*C. moschata*, Duchesne) are cultivated in many hot countries, including India, where they are stated to be used as a vegetable.

Sechium edule, *Swartz.*; Vegetable Pear, Choko, Chayote, Madeira Marrow, One-seeded Cucumber.

A perennial plant with tuberous rootstocks, native of the West Indies, commonly cultivated in the Tropics. Fruit eaten as a vegetable. The tuberous roots are edible, starch made from them is recommended as a substitute for "Arrowroot" (*Maranta arundinacea*), and the young shoots may be eaten cooked like "Asparagus." The green vines are good fodder.

1. Aug., 1887, "Chocho," pp. 6-9; 1896, p. 128.

Lagenaria vulgaris, *Seringe*; Bottle Gourd, Calabash Gourd, Pipe Calabash, Club Gourd.

Climbing annual, cosmopolitan in the Tropics and Sub-tropics

of both hemispheres. Some of the fruits of the numerous varieties are of doubtful quality, but others may be eaten freely. Heckel states that the pulp surrounding the seeds is poisonous and the juice violently purgative. In Japan the gourd is used as food after being thoroughly dried, the ends of the fruit are cut off, the seeds and pulp taken out, the outer or fleshy part cut into very thin slices and dried by hanging on sticks, in which condition it keeps for a considerable time. A sample of this "sliced and dried fruit" is in the Museum at Kew, from the Japan-British Exhibition, 1910. The gourd is cultivated in Japan for the purpose.

Telfairia occidentalis, Hook. f., of West Africa, and *T. pedata*, Hook. of East Africa are perennial climbing plants, cultivated for the seeds by the natives for food. The "Wax Gourd" (*Benincasa cerifera*, Savi.), cultivated in many warm countries, including Africa, India, China, Japan, Philippines, &c.; the fruit is commonly eaten like the vegetable marrow, used in curry or made into sweet-meat. The fruits of *Cephalandra indica*, Naud., of India, Java, Africa, &c., are eaten both raw and cooked, fresh when ripe and in curries, and as a vegetable when green.

Ia. ix. 2 (1911), "*Cucurbitaceae*," pp. 329-340.

CACTACEAE.

Opuntia spp.; Prickly Pear.

Succulent shrubs, 3 to 6 ft. high, native of the dry regions of Tropical America; grown in Texas, California, Arizona, and New Mexico. Various species have been introduced to Southern Europe, North and South Africa, Canary Islands, Madeira, India, and many other hot countries for the fruit.

There are several species that are esteemed for their excellent fruit in Mexico, where they are cultivated, distinguished as "white," "yellow," and "crimson," and one called "Xocnostle"—the fruit of which makes a most delicious preserve (*K.B.* 1892, p. 147). Various species, especially those that are nearly spineless, are used for feeding stock; but, although the yield is heavy, 20 tons and upwards, the feeding value is given as low, since from 80 to 90 per cent. of the plant is water. They are of importance as forage in regions so hot and dry that little else will grow there, and one has to remember in any movement to distribute them, that in many countries, South Africa, Australia, &c., where the "Prickly Pear" has been introduced, legislative measures, sooner or later, have been taken to destroy the plant or to keep it under control. The "Pelona," with yellow and crimson fruit, is by reason of its almost spineless character of special value in Mexico as a forage plant.

Cereus giganteus, Engl., and *C. Thurberi*, Engl., have edible fruits much esteemed by the Indians of New Mexico and Arizona.

1. 1888, "Prickly Pear in South Africa," pp. 165-173; 1890, *ibid.*, pp. 186-188, including extract from the Minutes of the Committee on the Eradication of the Prickly Pear; 1892; "Prickly Pear in Mexico," pp. 144-148; 1912, "Opuntias in the Canary Islands," pp. 395-396.

UMBELLIFERAE.

Carum Carvi, Linn.; Caraway.

Biennial, upwards of 2 ft. high, of Northern and Central Europe and Western Asia; naturalized in England, where it is cultivated to a limited extent in Essex and Kent; cultivated in Holland, North Russia, &c., whence the market is chiefly supplied. The fruits known as "Caraway Seeds" are well known for their use in confectionery and for flavouring liqueurs—"Kummel," a Russian preparation, especially. The fruits of "Dill" (*Peucedanum graveolens*, Bth.), an annual of Southern Europe, cultivated in England as a medicinal plant, have recently been submitted to Kew for identification, having been found in confectionery as a substitute in the present shortage of "Caraway."

2. May, 1911, "The Caraway Industry in Holland," pp. 134-137.

"Celery" (*Apium graveolens*, Linn.), "Carrot" (*Daucus Carota*, Linn.), "Parsnip" (*Peucedanum sativum*, Bth. & Hook.), "Parsley" (*Carum Petroselinum*, Bth.), "Fennel" (*Foeniculum vulgare*, Mill.), are all well-known garden plants in this Order. "Angelica" (*Archangelica officinalis*, Hoffm.), is cultivated in France for its leaf-stalks, usually candied with sugar and eaten as a sweetmeat. The "Hay Plant" (*Prangos pabularia*, Lindl.), of Tibet, is used in that country as a fodder plant. The roots of the "Sea Holly" (*Eryngium maritimum*, Linn.), a sea coast plant of Britain, are sometimes preserved in sugar and eaten as a sweetmeat. "Arracacha" (*Arracacia xanthorrhiza*, Bancr.) of the Andes, where it is cultivated for the tuberous roots, used as a vegetable; naturalized in Jamaica and used for a similar purpose.

1. Aug., 1887, "Arracacha" (*Arracacia esculenta*, DC.), pp. 10-15.

2. Sept., 1897, "Introduction of the Carrot into England," pp. 225-227; Sept., 1913, "The Cultivation of Carrots," pp. 503-507; July, 1916, "Carrots and Turnips as Catch Crops," pp. 366-367; Dec., 1913, "The Cultivation of Celery," pp. 793-796.

3a. No. 70, 1917, "The Cultivation of Parsnips."

RUBIACEAE.

Coffea arabica, Linn.; Arabian Coffee, Maragogipe Coffee, Mocha Coffee. **C. liberica**, Bull.; Liberian Coffee. **C. robusta**, Linden; Robusta Coffee, Rio Nunez Coffee, Congo Coffee. **C. stenophylla**, G. Don.; Highland Coffee of Sierra Leone.

Shrubs or small trees cultivated in various parts of the Tropics, the last-mentioned, although widely distributed from Kew to the Colonies, being perhaps the most limited as a trade source. Coffee as a beverage is well known; it was one of the earliest introduced into this country, the first London coffee house being established in St. Michael's Alley about 1652. It had been used in Constantinople for more than a century before. This would refer to Arabian coffee. The principal sources of the green berry are in general, Brazil (289307), Costa Rica (215264), Colombia (102811), Guatemala (97748), British India (75531), Nicaragua,

Mexico, San Salvador, Portuguese Possessions in India and Africa, French Somaliland, Turkey in Asia, Java, Venezuela, Ecuador, Peru, Liberia, Chile, Panama, East Africa Protectorate, Uganda, Nyasaland, and British West Indies, to a total in 1913 of 948,047 centals.

1. 1891, "Artificial Coffee Beans," pp. 201-204; 1894, "Coffee Cultivation in Angola," pp. 161-163; "Maragogipe Coffee," pp. 163-164.

1a. ix. 3 (1915), "*Coffea*," pp. 361-373.

"African" or "Negro Peach" (*Sarcocephalus esculentus*, Afzel.), a tree or shrub of West Africa has an edible fruit eaten by the natives.

COMPOSITAE.

***Helianthus annuus*, Linn.;** Sunflower.

Annual, varying according to variety from about 3 to 10 ft. in height, native probably of North America, common in Mexico, extending to Peru, and under cultivation in many tropical and sub-tropical countries. "American Giant," "White Russian," "Large Russian," &c., are strains commonly grown for seed.

The seeds are used for feeding poultry, and in Russia by the inhabitants there they are eaten like nuts; roasted and ground they are sometimes used as a substitute for coffee. They yield an oil suitable for culinary and table purposes, in the manufacture of margarine, and said to be equal to olive or almond oil, for which it is sometimes substituted. The residue, after the extraction of the oil, is pressed into cakes and used for feeding cattle—for which purpose it is considered advisable to grind it into as fine a meal as possible to admit of easier digestion, this cake being harder than most oil cakes, and almost impossible for cattle to chew in large pieces. The leaves mixed with bran are considered good fodder for cattle and horses. Sometimes sunflowers are grown thickly and cut for fodder, but the woody nature of the plant makes them undesirable for this purpose (Piper).

***Helianthus tuberosus*, Linn.;** Artichoke, Jerusalem Artichoke.

Herbaceous perennial, stems 6 to 10 ft. high, native of North America; introduced to Europe, Asia, Africa, &c.; cultivated generally for the tuberous roots as a vegetable and sometimes used as food for stock. "*Helianthi*" is a closely allied plant that has been advised as equal, if not superior, to the Jerusalem Artichoke; but experiments go to show that it is less valuable as a forage crop.

1a. ix. 3 (1915), "*Helianthus*," pp. 385-389.

2. Sept. 1894, "Sunflower Seed Cake," pp. 72-73; Aug. 1908, "Sunflower Seed," pp. 369-370; Feb. 1912, "Jerusalem Artichokes as Food for Stock," pp. 926-931; Feb. 1912, "*Helianthi* as a Food for Stock," pp. 937-938; April, 1918, "Jerusalem Artichokes," pp. 84-85.

***Cichorium Intybus*, Linn.;** Chicory, Succory.

Perennial, with a tuberous root. Europe, where, including

England, it is wild and cultivated. Raw or kiln-dried chicory is imported chiefly from Belgium (96136 out of a total of 96,804 centals in 1913), and since in lesser quantity from that country and in improved quantities from Denmark, France, Holland, Portugal, and United States. Roasted or Ground Chicory also came in from these countries, and also from Union of South Africa (80) to a total of 1491 centals in 1913. Chicory—root roasted and ground—is well known as a mixture with coffee; the blanched leaves may be used as a salad, and the plant is grown for forage, cattle, horses and sheep feeding freely upon it. Dried Chicory roots have also been recommended for feeding horses as a substitute for oats—"Chicory Crumbs" up to 10 lb. per day (Commerce Rep. Washington, No. 156, 1915; pp. 74-75).

2. Aug. 1904, "The Chicory Industry of Great Britain," pp. 268-271; Feb. 1915, "The Cultivation of Chicory," pp. 1019-1025.

***Achillea millefolium*, Linn.; Yarrow, Milfoil.**

Herbaceous perennial, 2 to 3 ft. high, a common wild plant in Northern Europe, including Britain, in North Asia, and North America, adapted to poor dry soil and recommended in permanent pastures, especially for sheep.

***Lactuca sativa*, Linn.; Lettuce.**

Annual, cultivated in many temperate countries and some hot countries, including India, Cuba, Africa, West Indies, &c., as a salad. Lettuces are imported into the United Kingdom from France and the Canary Islands in the early months of the year, before the home supplies become plentiful.

1a. ix. 3 (1915) pp. 395-396.

***Carthamus tinctorius*, Linn.; Safflower.**

Annual, about 3 ft., including spiny and spineless forms, probably native of Egypt; cultivated in the Sudan, Senaar, Abyssinia, India, China, South Europe, &c., chiefly for the dye from the florets and oil from the seeds; known in commerce as "Kurdee." The seeds are edible, especially after roasting, and are also good food for poultry. The oil expressed from the seeds, in addition to various industrial uses, may be used for culinary purposes, and the residual cake is a good cattle food. The young plants of the spineless forms may be used as fodder, and as a vegetable or pot-herb.

1a. 3 (1915), pp. 392-395.

The Order also includes "Niger" or "Ramtil" (*Guizotia abyssinica*, Cass.) of Tropical Africa, cultivated in India, oil from the seed used for culinary purposes; "Endive" (*Cichorium Endivia*, Linn.), a hardy annual commonly grown as a salad; "Cardoon" (*Cynara Cardunculus*, Linn.), a hardy perennial, blanched stalks of the inner leaves used in salads, &c.; the "Globe Artichoke" (*Cynara Scolymus*, Linn.), a hardy perennial, cultivated as a vegetable; "Scorzonera" (*Scorzonera hispanica*, Linn.), native of Spain, roots used as a vegetable; "Salsafy" (*Tragopogon porrifolius*, Linn.), cultivated as a

vegetable and "Wormwood" (*Artemisia maritima*, Linn.), abundant in the Western Himalayas, near the Caspian and Black Seas, in the Salt Plains of Western Tibet and in countries bordering the Mediterranean—fed upon by ponies in the Himalayas and suggested as a fodder plant where other vegetation is scarce (*K.B.* 1893, pp. 126-128).

VACCINIACEAE.

Oxycoccus palustris, Pers.; Common Cranberry. **O. macrocarpus**, Pers.; American Cranberry.

Small shrubby plants with creeping slender stems, found in boggy land, the former indigenous to Britain and alpine parts of Europe, Siberia and North America, and the latter native of North America, from Canada to Virginia.

Fruits of both are edible and commonly made into jam and jelly; those of *macrocarpus* are imported into the United Kingdom, exported from Nova Scotia, &c.

Vaccinium myrtillus, Linn.; Whortleberry, Bilberry. **V. Vitis-Idaea**, Linn.; Cowberry—small shrubs a foot or so high, native of Britain, and **V. corymbosum**, Linn.; Swamp Blueberry—a shrub about 7 ft. high, native of North America, where it is also cultivated. All the species in their wild state favour moist alpine or sub-alpine situations, and fruits of all are edible. In Britain those of the native species are collected about July and August for making into jam, jelly, &c., and moor game in autumn feed largely upon the fruits.

V. canadense, Kalm, and *V. pennsylvanicum*, Lam., are also known as "Blueberry" in Canada, where they are gathered for sale by settlers and Indians (*K.B.* Nov. 1887, p. 17). *V. Arctostaphylos*, Linn., is used in the Caucasus as a substitute for tea (*K.B.* 1895, pp. 61-63).

In the closely allied Order **Ericaceae** there is little of importance, but the following may be mentioned:—The "Strawberry Tree" (*Arbutus Unedo*, Linn.), fruits collected and eaten by the peasantry in Ireland (Johnson & Sowerby), "Bearberry" (*Arctostaphylos Uva-Ursi*, Spreng.), a trailing shrub of the Highlands of Scotland, fruits commonly eaten by grouse, *Gaultheria Shallon*, Pers., fruits eaten in Vancouver Island; "Winter Green" or "Partridge Berry" (*Gaultheria procumbens*, Linn.), of North America, the leaves called "Mountain" or "Salvador" Tea, used as a substitute for China Tea, "Labrador Tea" (*Ledum palustre*, Linn.), and "Heather" or "Ling" (*Calluna vulgaris*, Salisb.), which covers large areas (3,901,713 acres in England and Wales of Mountain and Heathland used for grazing, estimated in 1917), an important bee flower, "Heather Honey" being one of the standard kinds of commerce; the leaves, flowers, seeds and fine stalks of heather ground into meal are recommended for feeding poultry (*see* Journ. Bd. Agric. May, 1918, p. 185 and Leaflet No. 114), and grouse feed on the young shoots.

SAPOTACEAE.

Achras Sapota, Linn.; Sapodilla, Sapodilla Plum, Naseberry Milk Apple, Gum Chicle Tree.

A tree, 30 to 40 ft. high, native of the West Indies and Mexico; cultivated in many warm countries, including Central America, West Indies, British Guiana, India, Philippine Islands, Straits Settlements, West Africa, &c. The fruit is edible, described as one of the most delicately flavoured and wholesome fruits grown. It is said to stand transport well, but does not appear to come into the English market—fruits have been found to carry well from Demerara (*K.B.* 1888, p. 179). An extract known as "Chicle Gum" or "Sapodilla Gum" is obtained from the tree, which is an important article of commerce with America, where it is used in the manufacture of chewing gum.

1a. ix. 3 (1915), pp. 400-402.

Butyrospermum Parkii, Kotschy; Shea Butter, Beurre de Karité.

A tree 30 to 40 ft. high with a trunk 5 to 6 ft. in diam., native of West Africa, principally Nigeria. The kernels yield about 50 per cent. of fat known in commerce as "Shea Butter" as exported from the Niger, and the oil extracted from the kernels in England is known as "Shea Nut Oil." Used by the natives for food and in Europe for the manufacture of substitutes for butter in addition to other industrial uses. The total of Shea products exported from Lagos in 1913 was 2069 centals—1902 of which came to the United Kingdom, the remainder to countries not specified. The supplies are probably all from wild sources; there is a plantation at Oloke-meji in Nigeria and seeds and plants have been sent out from Kew to various Colonies; but the only definite information of success in growing the tree to maturity in countries outside of Africa comes from Dominica, where a tree sent out from Kew in 1899 was reported (1913) as a healthy plant 40 ft. in height, flowering freely but fruiting sparsely; fruits from this tree have recently (Sept. 1918) been received at Kew.

1. 1899, "Karité Tree," pp. 53-55.

1a. ix. 3 (1915), pp. 410-415.

The following have edible fruits:—"Star Apple" (*Chrysophyllum Cainito*, Linn.), "Marmalade Plum" (*Lucuma mammosa*, Gaertn.), trees native of the West Indies and South America; and "Miraculous Fruits" (*Synsepalum dulcificum*, Daniell), of West Africa—the fruits impart a sweet taste to anything bitter, sour or acid in character, used by the natives to sweeten palm-wine (*K.B.* 1906, p. 171). "Mahwa" (*Bassia latifolia*, Roxb.), and "Mee" or "Illipi" (*B. longifolia*, Linn.) of India yield an oil from the seeds used for culinary purposes in India, where the flowers of the trees are also eaten. The "Butter Tree" (*B. butyracea*, Roxb), of India, yields an oil or fat used for cooking or as an adulterant of "Ghee." The residual cake after the expression of the oil of these Bassias is

unfit for feeding purposes, being more or less poisonous. *Pouteria suavis*, Hemsl., of Uruguay, has edible fruits (*K.B.* 1906, pp. 365-366).

EBENACEAE.

Diospyros Kaki, *Linn.*; Persimmon.

A tree 30 to 40 ft. high, native of Japan; cultivated in France, India, America, Philippines, China, &c.

There are upwards of 100 varieties, of which there is a good range of specimen fruits (50 varieties) in the Museum at Kew. "In Central and Northern Japan the variety which produces large orange-coloured ovate thick-skinned fruit is the only one planted, and the cultivation of the red-fruited varieties is confined to the south." "The orange-coloured variety, fresh and dried, is consumed in immense quantities by the Japanese, who eat it as they do all their fruits, before it is ripe, and while it has the texture and consistency of a paving stone." (Sargent, *For. Fl. Japan*, p. 50). *Diospyros Roxburghii*, Carr. is the "Persimmon" of Western China and Eastern India.

1. 1911, "Persimmons," pp. 234-245.

"Monkey Guava" or "Zanzibar Ebony" (*D. mespiliformis*, Hochst.), a shrub or tree 10 to 40 ft. high, of Tropical Africa, has an edible fruit.

It may be noted that some of the fruits of *Diospyros* are poisonous, as, for instance, *D. Ebenaster*, Retz., with large globose fruits, 3 in. in diam., olive or yellowish-green coloured (*K.B.*, 1915, p. 67), and to all outward appearances a "Kaki" fruit. It is pounded and thrown into rivers to stupefy fish, in order to catch them for food, in the West Indies.

OLEACEAE.

Olea europaea, *Linn.*; Olive.

A tree, native of Syria and Greece; cultivated in the Mediterranean region, extending from Southern Spain to Southern Russia, and also in California and Australia.

The oil obtained from the pulp of the fruit is well known as a salad oil, and it is also used in the tinning of sardines; the fresh fruits are used for dessert. The imports of olive oil into the United Kingdom in 1913 were for "Refined," 6,163 tuns from France, Spain, Italy, Greece, Turkey, and Crete, and of "Unrefined," 2,882 tuns, from the same countries, including the Netherlands.

BORAGINACEAE.

Symphytum asperrium, *Donn.*; Forage Comfrey, Prickly Comfrey.

Perennial, 4 ft. high, native of the Caucasus, grown as a forage plant in Europe, including England (where it was introduced more than a century ago), and in America, recommended as a soiling crop for pigs, sheep, and cows.

CONVOLVULACEAE.

***Ipomoea Batatas*, Lám.; Sweet Potato, Spanish Potato.**

A perennial plant with a tuberous root and vine-like stems; cultivated throughout the Tropics of the Old and New Worlds and in many sub-tropical countries under upwards of 50 varieties. The roots or tubers are used for food in much the same way as those of the common potato; they are also fed to animals, but owing to the high percentage of starch they are recommended to be mixed with some fodder of greater nitrogenous value, as "Pea Nuts" (*Arachis hypogaea*) and other fodders in *Leguminosae* (see p. 7) Cotton-seed meal or grain to form a suitable ration. The stems and leaves (or vines) are good fodder, green or dried, for cattle, sheep, and pigs. There is a small trade between Barbados and this country and between Algiers and Paris, in the tubers, and in 1913, 3,360 centals of starch obtained from the tubers of this plant were imported into the United Kingdom from Natal.

The stems and leaves of *Ipomoea digitata*, Linn. of Tropical Africa, India, &c., are used as fodder for cattle in India (Watt).

la. ix. 3 (1915) pp. 475-479.

SOLANACEAE.

***Lycopersicum esculentum*, Mill.; Tomato.**

Cultivated in most warm countries for the fruit. Tomato-growing is an important industry in Italy, Sicily, United States, Mexico, West Indies, Egypt, Canary Islands, &c. It is estimated that in Italy, in the Province of Parma chiefly, there are 1,881,600 centals preserved annually for food—the skins being used for feeding stock—and Italian Tomato Paste is largely imported into the United States. Approximately 10,000,000 cases annually are turned out from the canning factories of the United States. and shipments of ripe tomatoes from the Gulf Coast region of Mexico are made in large quantities to the markets of that country. In the United Kingdom the imports of fresh fruit in 1913, chiefly from Channel Islands, Canary Islands, Spain, Holland, France, Portugal, and Italy, amounted to 1,772,944 centals, and there is also a large trade in home produce, grown under glass chiefly, and also out of doors.

la. ix. 3 (1915) pp. 480-482.

***Solanum tuberosum*, Linn.; Potato.**

An annual plant, native of Chile, but spread by cultivation over nearly the whole world—warm, temperate, sub-tropical, and tropical. Used chiefly as a vegetable, but the production of dried potatoes, starch, and flour, are important industries. Potatoes are imported on a large scale from Holland (3169685), Germany (2586144), France (1708157), Belgium (1122276), Channel Islands (1233060), Spain (244186), Canary Islands, Portugal, Norway, Denmark, Algeria, Malta, and Gozo, to a total of 10,558,594 centals. The home production in the same year amounted to 170,347,609 centals, under an acreage of 1,173,418. 546,769 centals of potatoes were exported from the United Kingdom, and 1,010,104 centals of "Farina" or

"Potato Starch" were imported, chiefly from Central Europe and the United States.

1a. ix. 3 (1915), pp. 485-487.

2. Numerous notes and papers.

3. No. 173, 1918, "Potato Growing"; No. 296, 1918, "Potato Growing in Allotments and Small Gardens" No. 299, 1917, "Storage of Potatoes and other Vegetables for Winter Use."

3a. No. 67, 1916, "Economy in Using Potatoes"; No. 69, 1917, "The Culture of Early Potatoes under Glass"; No. 74, 1917, "Cutting of Seed Potatoes."

The "Garden Egg," "Egg Plant" or "Brinjal" (*Solanum Melongena*, Linn.), a shrubby spiny plant 3 to 4 ft. high, is commonly grown as a vegetable in most warm countries, including China, India, West Indies, Tropical Africa, Southern Europe, &c. "Melon Pear" or "Pepino" (*S. muricatum*, Ait.), of Peru, has an edible fruit. It has been tried at Kew and in the gardens of the Royal Horticultural Society; but the fruits grown under glass have been found to be decidedly inferior to those grown in its native country, and quite unsuitable as a dessert fruit here (*K.B.* 1893, p. 21).

Capsicum annuum, Linn.; Capsicum, Red Pepper.

An annual, widely distributed in the Tropics.

Capsicum frutescens, Linn.; Capsicum, Chillies, Bird Pepper.

A small shrub, common throughout all tropical countries.

The Capsicums generally are used chiefly as condiments, "Cayenne Pepper" being made from the more pungent kinds, and the milder fruits as a vegetable, stuffed with meat and baked, or eaten raw as a salad. An extensive trade is done in the fruits under the name "Capsicums" and "Chillies," the former being broadly used for the larger fruits and the latter for the smaller. The principal sources of supply are Zanzibar, Uganda, Nyasaland, British East Africa, Sierra Leone, Natal, India, Japan and the West Indies, the total trade approximating to 100 tons a year (*see* Returns under *Piper nigrum* from Japan. British East Africa, and other British Possessions; probably all "Capsicums").

1. 1898, "Chillies," pp. 171-175.

1a. ix. 3 (1915), "*Capsicum*," pp. 489-492.

The "Cape Gooseberry" (*Physalis peruviana*, Linn.), a shrubby plant 2 to 3 ft. high, native of Peru, widely distributed in the Tropics; makes a good preserve. The "Tree Tomato" (*Cyphomandra betacea*, Sendt.), a shrub or small tree, 8 to 12 ft. high, native of Peru, cultivated in East Africa, West Indies, Southern Europe, &c., has an edible fruit which may be eaten raw or cooked like the ordinary tomato, and makes a good preserve and jelly.

1. Aug. 1887, "Tree Tomato," pp. 2-6.

1a. ix. 3 (1915), "*Physalis*," pp. 487-488; "*Cyphomandra*," pp. 488-489.

PEDALIACEAE.

Sesamum indicum, Linn.; Sesame, Gingelly or Gingili (India), Til (Bengal), Benniseed (Sierra Leone), Sim-sim (Sudan, E. Africa), Goma (Japan).

Annual, believed to be a native of Tropical Africa; widely spread by cultivation in the Tropics and Sub-tropics. The chief use of the plant is in the production of oil from the seed—black and white, the best quality oil being obtained from the white seed—used everywhere as food and as a substitute for olive oil. The seeds are made into sweetmeats and toasted and ground they are made into cakes, and they have also been submitted to Kew for identification with the statement “found in raspberry jam.” The cake made from the residue after the extraction of the oil is an important cattle food. Cases of poisoning have been known to occur, believed to be due to the presence of soluble oxalates or free oxalic acid in the seed.

There is a large trade in the seed in Europe, of which Marseilles is perhaps the most important centre, with India, China, and Africa the main sources of supply. The Customs Returns were included in “Seeds unenumerated” prior to 1917, in which year the amount imported into the United Kingdom was 115,404 quarters chiefly from British India (92,778 qrs.), China (13,120 qrs.), Nigeria (7,587 qrs), and the remainder from other foreign countries and British Possessions not enumerated.

The seeds of *Ceratotheca sesamoides*, Endl., are eaten like those of *Sesamum* in Uganda.

1a. ix. 3 (1915), pp. 511-514.

LABIATEAE.

Coleus rotundifolius, A. Chev.; Madagascar Potato, Hausa Potato, Salaga (Togoland) Potato, Fra-Fra (Gold Coast) Potato.

Perennial, 1 ft. high, cultivated in many parts of Tropical Africa and in Java, Ceylon, Mauritius, Madagascar, &c., for the tubers, used as food, like the ordinary potato.

1a. ix. 3 (1915), pp. 531-533.

The “Umbondive” or “Kaffir Potato” (*Plectranthus esculentus*, N. E. Br.), is a favourite food of the natives in Natal, and “Risga” (Hausa) (*Plectranthus floribundus*, N. E. Br., var. *longipes*) is cultivated in Nigeria for the tuberous root-stocks, used as food, and they are also so used in Southern Rhodesia. “Benefing” (*Hyptis spicigera*, Lam.), an annual, 5 ft. high, of French West Africa, is cultivated and used for food in much the same way as *Sesamum indicum* in British West Africa, Uganda, Nile region, &c. The tubers of “Crosnes” or “Chinese Artichoke” (*Stachys Sieboldii*, Miq.), are used for food in China and Japan, where the plant is cultivated for the purpose: introduced into Britain as a new esculent in 1885, and also cultivated in France for the Paris markets. The well-known culinary herbs “Thyme” (*Thymus vulgaris*, Linn.), “Marjoram” or “Sweet Marjoram” (*Origanum Marjorana*, Linn.), and “Mint” (*Mentha viridis*, Linn.), also belong to this Order. (K.B., 1916, “Culinary Herbs,” pp. 202-203.)

AMARANTACEAE.

Amaranthus caudatus, *Linn.*; Love-lies-bleeding, Ramdana (India).

Annual, 1 to 3 ft. high, cultivated in India for the seed used as food (Watt), and in Tropical Africa the plant is cultivated for use as spinach (Chevalier, Bull. Soc. Nat. d'Accl. 1912, reprint p. 30).

Amaranthus paniculatus, *Linn.*; Common Amaranth.

Annual, 2 to 3 ft., native of Tropical Africa, India, &c. The grain is one of the most important sources of food with the hill tribes in India (Watt); leaves and shoots used for salad in West Africa.

Amaranthus polygamus, *Linn.*; an annual plant, is cultivated throughout India and all over the southern parts of Asia as a pot-herb (Watt), and other species might be mentioned for use in the same way.

CHENOPODIACEAE.

Atriplex semibaccata, *R. Br.*; Salt Bush, Half-berried Salt Bush.

A perennial spreading herb, 1 to 2 ft. high, native of Australia; cultivated in California on alkali lands for forage, also cultivated experimentally in Antigua. It is a "plant held in much esteem by stock owners as a most valuable herb for sheep, which eat it down with avidity" (Turner).

"Slender Salt Bush" (*A. leptocarpa*, F. Muell.), of Australia has also been introduced to California. *Atriplex halimoides*, Lindl., of Australia; "Garden Orache" or "Mountain Spinach" (*A. hortensis*, Linn.), of Northern Asia—a favourite vegetable in India and much cultivated in France for its large succulent leaves and as spinach and "Cape Salt Bush" (*A. Halimus*, Linn.), of Southern Europe and the Mediterranean region, are grown at Kew as ornamental plants. The last-mentioned is grown in the Isle of Wight and elsewhere near the sea as a hedge plant; but none appear to have been grown in England for forage.

Chenopodium Quinoa, *Willd.*; Quinoa.

Annual, 3 to 5 ft., native of the Andes of Chile, Peru and Bolivia, where it is an important article of food of the inhabitants, principally Indians of the labouring class. The plant has been introduced to India from Peru, but so far with comparatively little success. The plant flourishes at high altitudes (there is a good set of specimens of seeds from Lake Titicaca, Bolivia, altitude 12-13,000 ft., in the Kew Museum) where the climate is more or less temperate. It has been suggested as a food crop in England; but although it has been grown on a small scale to maturity at Kew, it is probable that no advantage would be gained by cultivating it on a large scale. The seeds are very small (about 15,000 to the ounce) and might for value as a

food be considered parallel with those of *Digitaria Iburu* in Nigeria and *Eleusine coracana* in India (see under *Gramineae*), with a people amongst whom the trouble of preparation can only be appreciated because the material and labour are plentiful and cheap.

"Blue Bush" (*Chenopodium auricomum*, Lindl.), a plant 5 ft. high and upwards is a superior pasture plant "which stock of all kinds are remarkably fond of" (Turner), and the succulent stems and leaves are an excellent table vegetable when cooked as Spinach (Maiden). The "Goosefoot Salt Bush" (*C. atriplicinum*, F. Muell.), a foot or so high, "forms a dense mass of nutritious succulent herbage" and the "Nitre Bush" (*C. nitrariaceum*, F. Muell.), a branching undershrub from 3 to 4 ft. in height (8 ft. under cultivation) of which it is stated "sheep in eating this bush often trim it as neatly as if it had been clipped with handshears" (Turner), are all natives of Australia. It may be mentioned here that there are other species of this genus and of *Kochia* and *Rhagodia* that are known as "Salt Bushes," more or less valuable for forage, included in the Order. "White Goose Foot" (*C. album*, Linn.), a common weed in Britain, on the Continent and in Temperate Asia, is cultivated as a food grain, pot-herb and vegetable in India (Watt). "Australian Spinach" (*C. murale*, Linn.), of the southern colonies, Australia, is used as a pot-herb (Maiden). "Uauhtzontli" (*C. Nuttalliae*, Safford), is cultivated as a food plant by the Aztecs in Mexico (Safford, Journ. Washington Acad. Sci. viii. Sept. 1918, pp. 521-527).

1. 1896, "Sheep Bushes and Salt Bushes," pp. 129-140; 1897, "Fat Hen in Australia (*Chenopodium album*)," pp. 218-219; 1909, "Australian Salt Bushes," pp. 30-32; 1909, "Quinoa," pp. 425-427.

Beta vulgaris, Linn.; Beetroot, Sugar Beet, Mangold or Mangel, Mangold Wurzel.

Biennial plants, usually cultivated as annuals, native of the shores of the Mediterranean and of the western coasts of Europe. The Sugar Beet includes the white varieties "blanche à sucre améliorée" (Vilmorin) and "blanche à sucre Klein-Wanzleben" (Vilmorin), grown largely in Europe and America for the production of sugar. When Achard initiated the manufacture of sugar from beetroot the white field variety was judged the most suitable; it contained from 8 to 10 per cent. of its weight in pure sugar; selection in the course of the next 50 years raised the percentage of sugar to 12 or 13 per cent. (of the gross weight of the root), and after 1850 a race was established by Vilmorin yielding 16 and even 18 per cent. of sugar, beyond which it is stated beetroots cease to vegetate properly and die. (K.B. 1897, p. 317.) The amount of unrefined beetroot sugar imported in 1913 was 15,267,165 centals, chiefly from Austria-Hungary (3603733), Denmark (704475), Germany, Holland, Belgium, and France (no returns given 1913). Experiments in growing Sugar Beet in England, more particularly Norfolk, have been made in conjunction with factories in Holland, and

the results go to show that the plant can be grown very successfully. (See Journ. Bd. Agric., June, 1911, and March, 1916, "Progress of the Sugar Beet Industry in Norfolk").

Syrup is also made from the root (a description of a simple process of making syrup is given in Journ. Bd. Agric., Dec., 1917, p. 1002). In the process of preparation for sugar the leaves and crowns may be fed to stock, used in the fresh stage, dried or as ensilage, and the pulp residue is also good fodder.

The Mangold is an important field crop at home, especially in the Southern and Midland Counties, on the Continent, and in America, under varieties broadly divided as white, yellow, and red-fleshed, including "globe," "tankard," and "long" forms; especially valuable as a winter feed for dairy cows and sheep. In 1913—207,785,289 centals were produced from 500,209 acres in the United Kingdom, England alone producing 166,532,150 centals of the whole amount of roots under an acreage of 409,150.

The "Red Beet" is well known in gardens everywhere as a vegetable, and the "Silver Beet" (*B. vulgaris*, var. *Cicla*) is grown for the leaf used as a vegetable, more especially in France.

"Spinach" (*Spinacea oleracea*, Linn.) is well known as a vegetable, and *Basella alba*, Linn., is cultivated in India, Africa, and West Indies, for use in the same way.

2. Numerous papers on Sugar Beet and Mangold.

3. No. 169, 1912, "Cultivation of Mangolds."

POLYGONACEAE.

Fagopyrum esculentum, Moench. (*Polygonum Fagopyrum*, Linn.), Buckwheat, Brank.

Annual, 3 ft., of which there are many cultivated varieties grown in Europe, Asia, China, India, &c., and in North America. Three varieties, "Japanese," "Silver Hull," and "Common Gray" are grown in the United States (Carleton). In Britain the plant is grown only to a limited extent, and chiefly on waste land. The grain is an important food in America, China, India, &c., and it is also largely used for feeding poultry and game. The green plant is used in America for forage; but it is said to be "sometimes injurious to sheep" (Farmer's Bull. U.S. Dept. Agric., No. 267, 1906, p. 13), or "to have a narcotic effect on sheep" (Johnson and Sowerby). The ground grain is used as a feed for hogs (Carleton). The flowers are a good bee food, and it is reported that in the Government of Tchernigov, Russia, it is the principal source of honey (Journ. Bd. Agric., June, 1895, p. 2).

The supply of buckwheat to the United Kingdom comes chiefly from Russia (43232), France (19062), United States (6854), and other Foreign Countries and British Colonies not specified, to a total (1913) of 78,046 centals.

"Tartarian Buckwheat" (*Fagopyrum tartaricum*, Gaertn.) is grown in the colder parts of North America and Asia—in Ladak, Zanskar, and Western Tibet. Leaves much used as a pot-herb in summer, when other green food is not easily

obtained (*K.B.*, 1893, p. 1). The var. *himalaica* is the "Kangra Buckwheat."

1. 1891, "Kangra Buckwheat," pp. 244-245; 1893, *ibid.*, pp. 1-3, "Common Buckwheat," p. 3.

2. Feb. 1916, "The Cultivation of Buckwheat," pp. 1128-1134; April, 1918, *ibid.*, pp. 81-84.

3a. Food Production, No. 42, 1918, *ibid.*

***Polygonum sachalinense*, F. Schmidt; Sachaline.**

Perennial, 6 to 10 ft. high, native of Japan and Island of Sachalin. A forage plant suitable as green feed for all kinds of stock. The plant yields 8 to 16 tons per acre, but in America possesses no advantage over Corn (Maize) or Sorghum. Sachaline was tested at many of the American experiment stations, but has not commended itself as worthy of culture except as an ornamental (Piper). The plant grows freely at Kew.

"Redshank" (*P. Persicaria*, Linn.), a common weed in Britain, is stated to be a nutritious plant, fed green to horses and cattle (Journ. Bd. Agric. July, 1918, "Weeds as Food," p. 384). "Rhubarb" (*Rheum Rhaponticum*, Linn.), a native of Southern Siberia, is well-known for the acid leaf-stalk. "Phog" (*Calligonum polygonoides*, Linn.), a small, densely branched shrub, 3 to 4 ft. high, of India, Persia, Arabia, Syria, Armenia, Egypt, Algeria, and the Canaries, is remarkable for the use of the flowers as food; they are succulent and are an important article of food in many parts of India; eaten raw or cooked, often with parched grain, and put into sweetmeats (*K.B.* 1889, pp. 217-221).

PIPERACEAE.

***Piper nigrum*, Linn.; Pepper.**

A woody climber, native of Malabar; cultivated in Malay Peninsula, Southern India, Borneo, Siam and other tropical regions for the berries or "Peppercorns," well known as a spice. "Black Pepper" is the dried unripe berries and "White Pepper" the ripe fruit with the outer coating removed before grinding. The Customs Returns under "Pepper" probably also include "Red Pepper" or "Capsicum," the sources given being Straits Settlements, including Labuan (54075), Java (29555), British India (13870), Siam (12745), French Indo-China (8890), Ceylon (1475), [British East Africa (1148), Japan (958), British Possessions not enumerated (2070), probably all *Capsicum*], Germany, Holland, France and foreign countries not enumerated, to a total of 131,767 centsals.

1. 1893, "Pepper in Siam," p. 230.

MYRISTICACEAE.

***Myristica fragrans*, Houtt.; Nutmeg.**

A bushy tree 30 to 40 ft. high, native of the Moluccas or Spice Islands of Banda; cultivated in Malaya, Java, West Indies; introduced to Ceylon, Mauritius, South America, West Africa, Zanzibar, and other tropical countries, but there is no production of importance excepting perhaps in the West Indies.

The Banda Islands are the most important trade source of Nutmegs. The "mace" (or the "Arillus," which when fresh is bright red) is also imported as a spice.

LAURINEAE.

***Persea gratissima*, Gaertn.; Avocado Pear.**

A tree, 20 to 30 ft. high, commonly cultivated in the Tropics for the fruit. A trade under cold storage from Dominica was suggested in 1888 (*K.B.*, p. 209) and two consignments from the Bahamas to New York and London (1910) carried with a loss of only 2.9 per cent. (Bull. Dept. Agric. Bahamas, Sept., 1910). The fruit comes occasionally into Covent Garden market and fruits have been noted in Liverpool shops (*K.B.*, 1908, p. 189). Avocado Pears are exported from Hawaii to the United States, and it is reported that shipments arrive at Chicago in very good condition.

***Cinnamomum zeylanicum*, Breyn.; Cinnamon.**

A tree 20 to 40 ft., native of Ceylon, where under cultivation the greater amount of bark is produced. Grown to a smaller extent in India, Java, Seychelles, and French Guiana. The bark, used chiefly as a spice, is imported from Ceylon (6359), Seychelles (1008), British Possessions, not enumerated (7910), and foreign countries, not enumerated (174), in 1913.

"Bay Laurel" or "Sweet Bay" (*Laurus nobilis*, Linn.) leaves are used in cookery; they are often confounded with those of the "Common Laurel," "Cherry Laurel" or "Magnolia-leaved Laurel" (*Prunus Laurocerasus*, Linn.), which, although sometimes used for flavouring in the same way, are known to contain hydrocyanic acid and to produce injurious and even fatal results, and their use should not be permitted. It is only the "Sweet Bay" leaf that is safe to use.

EUPHORBIACEAE.

***Manihot utilisima*, Pohl; Cassava, Mandioca, Tapioca.**

A shrub, 6 to 10 ft. high; but varying according to variety, of which there are many from about 3 ft. to the maximum height. Native of Brazil; cultivated more or less throughout Tropical America, Asia and Africa. The flour or starch obtained from the large tuberous roots is everywhere an important food. The flour has somewhat the appearance of coarse oatmeal, and "Tapioca," the preparation best known in this country, is a pure form of starch which settles from the water in washing the Cassava meal, and afterwards granulated on hot plates. "Mandioca" or "Tapioca" flour is imported from Holland, Java, Brazil and Straits Settlements—720,509 centals in all for 1913, and "Cassava Powder" and "Tapioca" imports in the same year came from the same sources to a total of 325,005 centals.

Two important variations exist in the roots usually distinguished as "Sweet" (sometimes called *M. palmata*, var. *Aipi*) and "Bitter" Cassava (*M. utilisima*). The last-mentioned is found to be more or less poisonous, due to prussic acid content,

and it is essential to have the poisonous juice separated by grating, washing and cooking before being eaten. From this same juice, however, the product known as "Cassareep" by boiling down is obtained. It is largely used in the West Indies for culinary purposes, and in this country for the preparation of various table sauces.

The "Herbert River" or "Queensland Cherry" (*Antidesma dallachyanum*, Baill.), a shrub or small tree, has an edible fruit said to be equal to that of the "Red Currant" (*Ribes rubrum*) when made into jelly (K.B. 1895, p. 272). The fruits of *Antidesma Bunias*, Spr., are used for preserving and the acid fruits of the "Otaheite Gooseberry" (*Phyllanthus distichus*, Muell. Arg.), are used for pickling in Java, where also the fruits of *Baccaurea racemosa*, Muell. Arg., are eaten. The "Emblie Myrobalan" (*Phyllanthus Emblica*, Linn.), a small tree of India and Burma, and "Rambeh" (*Baccaurea dulcis*, Muell. Arg.), have edible fruits. The seeds of "Jamaica Cob Nut" or "Hog Nut" (*Omphalea triandra*, Linn.), a small tree of the West Indies, are eaten raw or roasted.

URTICACEÆ.

Humulus Lupulus, Linn.; Hop.

A twining perennial plant, native of Europe, Caucasus, Central Asia, &c., and found wild in England; cultivated in Belgium, Bavaria, Russia, United States, &c. The female flowering cones ("catkins" or "strobiles") known as "hops" are used in brewing beer. The young shoots, when about 4 to 5 in. long, thinned from the plants are used as a vegetable in Belgium and are recommended for a similar use in this country, the thinnings from the hop-fields at the time the plants are starting into growth, are estimated at about 70 lb. per acre (Journ. Bd. Agric., Jan., 1910, p. 581). "Hops" in 1913 were imported from United States, Germany, Belgium, Canada, Holland, Russia, Austria-Hungary, France, New Zealand, Australia, and Mexico, to the amount of 293,646 centals. In the same year the home production was 286,318 centals from 35,676 acres in the counties of Kent, Hants, Hereford, Surrey, Sussex, Worcester, and to the least extent in Gloucestershire, Salop, and Staffordshire.

2. Numerous references.

Cannabis sativa, Linn.; Hemp.

Annual, 4 to 8 ft., native of the temperate parts of Asia, near the Caspian Sea, Persia, &c.; cultivated in Europe, India, America, Siberia, &c. The seed produced in most of the countries mentioned above, where the plant is grown for fibre, is well known for feeding birds, and the oil extracted by cold pressure is used for cooking, and the oil-cake is an important food for stock.

Morus alba, Linn.; White Mulberry.

A small deciduous tree, native of Northern and Western Asia, cultivated in Northern India, China, Japan, and Southern

Europe for its leaves—showing a great variety—used for feeding silkworms. The fruit is edible.

Morus nigra, Linn.; Black Mulberry.

A deciduous tree, about 30 ft. high, believed to be a native of Persia, the Caucasus and Armenia, and occurring apparently wild in Italy, Sicily and Greece. Cultivated in Northern India and the Nilgiris for purposes of sericulture (Watt). Fruit edible but subject to decay quickly, well-known as a dessert fruit and may be made into preserve.

Ficus Carica, Linn.; Fig.

A small tree or straggling bush, native of Syria and Asia Minor; cultivated in Southern Europe, to some extent in the south of England, in Western Asia and the United States.

Preserved figs and "fig cake" are imported from Asiatic Turkey, Portugal, Spain, France, Algeria, Greece and United States, the amount in 1913 being 180,579 cents. The largest and best figs are those of Smyrna or Turkey.

The "Sycamore Fig" or "Fig of Pharaoh" (*Ficus Sycomorus*, Linn.), a large tree of Egypt, has an edible fruit, which, though not so fine as the above, is said to be very agreeable and apparently much used by the Arabs.

Artocarpus incisa, Linn.; Bread Fruit, Bread Nut.

A large tree, native of the South Sea Islands, where the fruit is a staple food. Introduced to other tropical countries, including Asia, Africa, America, West Indies, &c. The story of Capt. Bligh and the introduction (in 1793) of plants to the West Indies is familiar to all. There are two forms of the tree, one with seedless fruit and one with seeds—this being known as the "Bread Nut," also an important food of the natives in the countries where the trees are grown.

"Jack Fruit" (*Artocarpus integrifolia*, Linn.), a tree of Southern Asia, is remarkable for its large fruit developed on the trunk; used as food by the natives of India. The seeds of "Okwa" or "African Bread Fruit" (*Treculia africana*, Dec.), of West Africa are ground up into meal and used there for food. The "Bagolaro" or "Nettle Tree" (*Celtis australis*, Linn.), native of the Mediterranean region, is cultivated in Southern Italy, France, &c., as an ornamental tree and on large areas for the timber; the fruit known as "Honey Berry" is eaten in Spain and Greece (*K.B.* 1914, p. 348). The "Common Nettle" (*Urtica dioica*, Linn.), a weed in Europe, is stated to be grown for forage in Sweden, recommended in Portugal and France—the cut plants withered or dried as hay lose their stinging properties and the composition is similar to that of best meadow hay—said to be suitable for dairy cows in amounts not exceeding one-quarter of the weight of the ration, for pigs mixed with offals and potatoes and for poultry finely powdered and mixed with offals, potatoes or flour (*Inter. Rev. Sci. & Pract. Agric.* Rome, Jan. 1917, p. 77); used in Hungary for fodder (*Nat. Food Journ.*, June 12th, 1918, p. 496).

JUGLANDACEÆ.

Carya alba, *Nutt.*; Shell-bark Hickory.

A tree upwards of 80 ft., of North America, where the nuts are an important article of commerce, most of the Hickory nuts on the market being produced by this species (*K.B.*, 1911, p. 305).

Carya olivaeformis, *Nutt.*; Pecan Nut.

A tree upwards of 80 ft., of the Southern United States; nuts imported into the markets of this country for dessert.

Carya porcina, *Nutt.*; Pig Nut.

A tree, 80 ft., of North America; nuts edible, but not so important as other species in America on account of the thick shells and small kernels.

Carya sulcata, *Nutt.*; Big Shell-bark Hickory.

A tree 100 ft., of North America, where the nuts always find a ready market.

Carya tomentosa, *Nutt.*; Mocker Nut Hickory.

A tree 90 to 100 ft., indigenous to the middle and southern States of North America, from the coast westwards to Nebraska and Kansas. The nuts are an important article of trade and the tree is cultivated for their production as well as for timber (*l.c.*).

All the Hickories mentioned have been introduced into England, but are not grown on a forest scale.

1. 1911, "The Hickories," pp. 304-307.

Juglans regia, *Linn.*; Common Walnut.

A tree of the Caucasus and Armenia, extending to the Himalayas and well-known in Britain, where the nuts are dried for dessert and the fruits often pickled in a green state—this being one of the standard "pickles" commonly sold; dried ripe nuts are imported from the south of France. An oil is obtained from the kernel that may be used as salad oil.

CUPULIFERÆ.

Corylus Avellana, *Linn.*; Common Hazel, Filbert, Barcelona Nut, Cob Nut.

A large bush, 10 to 15 ft., of Europe, Western Asia, &c.

Corylus Colurna, *Linn.*; Constantinople Hazel, Turkey Filbert.

A tree 60 to 80 ft., of South East Europe, Asia Minor, extending to the Himalayas.

Filberts and Cob Nuts are grown largely in Kent. Barcelona Nuts are imported from Tarragona in Catalonia, Spain, and Turkey Filberts from Smyrna, well-known as dessert nuts and used also in the preparation of nut-foods.

Corylus Jacquemontii, Dec. (*C. lacera*, Wall.), a moderate-sized tree of North West Himalaya, bears nuts smaller than those of the European Hazel, but they are "nearly as good and

are largely eaten, being exported from the various hill stations in the Himalaya" (Watt), to other parts of India.

1. 1911, "*Corylus Colurna* var. *chinensis*," pp. 327-328; 1913, "A Himalayan Tree Hazel," pp. 163-164.

The Acorns of the "Sweet Acorn Oak" (*Quercus Ilex*, Linn. var. *Ballota*), of Spain and Portugal are sold in the markets of Spain and Morocco, where they are used as food. The Acorns of "Turkey Oak" (*Q. Cerris*, Linn.), of Europe, Asia Minor, &c., and "Common Oak" (*Q. pedunculata*, Ehrh., and *sessiliflora*, Salisb.), of Europe and Asia, have been used and recommended for feeding stock, pigs especially. The fruits or "mast" of "Common Beech" (*Fagus sylvatica*, Linn.), of Europe, Asia Minor, &c., have been recommended for a similar purpose and from these also an oil is obtained in Southern Germany and France, suitable for table use.

1. 1894, "Table Oils from Beech and Linden," p. 218.
2. Sept. 1914, "The Value of Acorns, Horse Chestnuts and Beech Mast as Food for Stock," pp. 511-528; Oct., 1915, "The Feeding of Acorns to Live Stock," pp. 686-687; Oct., 1916, "Food Value of Acorns, Horse Chestnuts, and Beech Mast," p. 690; Nov., 1917, "Acorns for Pig Feeding," pp. 922-923; Aug., 1918, "Acorns as Food for Poultry," pp. 573-576.
3. No. 13, 1917, "Acorn Poisoning"; No. 291, 1917, "The Food Value of Acorns and Beech Mast."

Castanea sativa, Mill.; Sweet Chestnut.

A large tree of Southern Europe, North Africa, Orient, &c. The nuts are an important article of food in the Apennines (Mus. Kew), and in most countries where grown; imported into the United Kingdom from Spain and other South European countries. the largest and best nuts being obtained from cultivated trees grafted on wild stocks. Introduced to the North-West Himalaya. where the nuts are sold in the bazaars. Smoked and dried chestnuts and flour are shown in the Kew Museum, as used for food at Castagliano in the mountains of Pistoja, Italy.

1. 1890, "Chestnut Flour," pp. 173-174.

SCITAMINEAE.

Musa sapientum, Linn.; Banana.

A herbaceous perennial, varying in height from about 20 to 25 ft.; cultivated in many tropical countries—Asia, Africa, America, Queensland, West Indies, &c. The principal supplies of fruit are chiefly from Costa Rica (2,614,186 bunches), Colombia (2,555,504 bunches), Canary Islands (2,138,080 bunches), and British West Indies (499,763 bunches), the remainder, 32,451 bunches, from Foreign Countries not enumerated, making a total of 7,539,984 bunches for 1913.

The banana grown in Jamaica and Costa Rica is the variety "*Gros Michael*," which grows 18 to 20 ft. high (Fawcett) with fruit larger and coarser than that of the "Canary Banana" (*Musa Cavendishii*, Lamb.), a smaller plant growing about 6 ft. high. The var. *paradisica* is the "Plantain," grown in the

Tropics, used as a vegetable, eaten cooked, and as an article of food it is indispensable to the natives of the countries where grown.

1. 1894, "Species and Principal Varieties of *Musa*," pp. 229-314 (reprinted as Additional Series VI. ii); 1908, "Banana Cultivation in Egypt," pp. 102-105; 1913, "Varieties of Plantains and Bananas Cultivated in the Seychelles," pp. 229-231.

***Zingiber officinale*, Rosc.; Ginger.**

A perennial about 2 ft. high, cultivated in Asia, West Africa Sierra Leone, &c., in the West Indies—Jamaica especially, &c., for the rhizomes, dried for use as a spice and the green rhizome is preserved in syrup. The imports of ginger into the United Kingdom come chiefly from British India (23359), British West Indies (12311), Sierra Leone (6767), Japan (1146), other Foreign Countries (283) and other British Possessions (122), not enumerated to a total of 43,988 cents in 1913. The rhizomes of *Alpinia nutans*, Rosc., are sometimes used in India as a substitute for the true ginger.

1. 1892, "Chinese Ginger," pp. 16-20; "Fiji Ginger," pp. 77-81.

***Maranta arundinacea*, Linn.; Arrowroot.**

A perennial, 2 ft. high and upwards, native of Tropical America, Brazil and West Indies. Cultivated for the starch obtained from the rhizomes, produced largely in Bermuda and St. Vincent. "Queensland Arrowroot" is the starch obtained from the tuberous roots of *Canna edulis*, Ker.

The imported Arrowroot from the British West Indies amounted in 1913 to 40,160, and from other British Possessions 615 cents.

The rhizomes of "Turmeric" (*Curcuma longa*, Linn.), cultivated in India, East Indies, Ceylon, &c., are used largely as a condiment in India and in the preparation of "Curry Powder." The tubers of "Topee Tambo" or "Tokee Tambo" (*Calathea Allouya*, Lindl.), are used as food in Trinidad and Dominica; the plant is widely distributed in Tropical America.

1. 1892, "Allouya Tubers (*Calathea Allouya*)," pp. 244-245; 1893, "St. Vincent Arrowroot," pp. 191-204, 360-361; 1893, "Arrowroot (*Canna edulis*)," pp. 331-333; 1898, "Bermuda Arrowroot," pp. 50-51.

***Ananas sativus*, Schult. f.; Pine Apple.**

An annual plant, perennial by suckering freely, commonly cultivated in the Tropics, and to a small extent in hot-houses at home. Fresh fruit is largely imported from the Azores, grown under glass, and from Teneriffe; preserved fruit from Siam, Hawaii, Florida, Straits Settlements, Australia, &c., 302,086 cents being imported in 1913.

Puya edulis, Morren, yields a starch from the leaves, reported to have saved the lives of thousands of Indians in Brazil during famine (*K.B.*, 1889, p. 20).

TACCACEAE.

Tacca pinnatifida, *Forst.*; Tacca Arrowroot, Southsea Arrowroot.

A herbaceous perennial plant with globose rootstock, native of Fiji, South Sea Islands, and found in Tropical Africa.

The arrowroot or starch obtained from the root is an important food of the natives of the South Sea Islands. "Tacca Arrowroot" is preferable to any other in cases of dysentery and diarrhoea." Tubers received at Kew in 1890 from Fiji were distributed to the botanical departments of Jamaica, Trinidad, and Lagos (*K.B.*, 1892, p. 51).

DIOSCOREACEAE.

Dioscorea alata, *Linn.*; The Wing-stalked Yam, Barbados Yam. **D. bulbifera**, *Linn.* (*D. sativa*, *Benth.*); Common Yam, Otaheite Potato, of Tropical Asia, Africa, America, West Indies, &c. **D. fasciculata**, *Rowb.*; the Kidney-shaped Yam, Kareem Potato, of India.

Climbing perennials, of which there are many varieties under each species cultivated in the countries named. The tuberous roots are an important food, to a large extent occupying much the same place in the Tropics as the potato in temperate countries.

The rootstocks of "Elephant's Foot" (*Testudinaria elephantipes*, *Lindl.*) may be mentioned as somewhat of a curiosity, called "Hottentot's Bread," the fleshy inside having been used as food by the Hottentots in times of scarcity.

LILLIACEAE.

Allium Cepa, *Linn.*; Onion.

A bulbous annual, cultivated in many temperate, sub-tropical and tropical countries. In addition to a large trade in home-grown produce, of which a large proportion is grown in Bedfordshire, onions are imported from Spain (5,074,087 bus.), Egypt (1,709,934 bus.), Holland (1,522,133 bus.), France (264,022 bus.), Belgium (250,774 bus.), Germany (150,334 bus.), Portugal (90,993 bus.), Malta & Gozo (31,250 bus.) &c., to the amount in 1913 of 9,105,164 bushels.

The "Leek" (*Allium Porrum*, *Linn.*), "Garlic" (*Allium sativum*, *Linn.*), "Shallot" or "Eschalot" (*Allium ascalonicum*, *Linn.*), and "Chives" (*A. schoenoprasum*, *Linn.*), are well-known vegetables of the genus. "Bibrous" or "Bibraz" (*Allium triquetrum*, *Linn.*), is used like the Leek in Algeria, where it is very common on the littoral, especially in the neighbourhood of dwellings and in gardens, and the plants are collected in great numbers by women in the hedge-rows and fields.

1. 1913, "*Allium triquetrum* as a Vegetable," pp. 239-240.

2. June, 1897, "Effect of Wild Garlic on Milk," pp. 73-75; Dec. 1902, "The Brined Onion Industry," pp. 349-354 (see also "Report on the Dutch Brined Vegetable Industry," Cd. 1368 (1902); March, 1895, "Cultivating Onions in Egypt," pp. 333-335; Nov. 1911, "The Cultivation of Onions," pp. 638-642; March, 1918, "Is Onion Growing Worth While?" pp. 1378-1384; April, 1917, "The Cultivation of the Leek," pp. 66-68.

3. No. 264, 1912, "The Cultivation of Onions."

The flowers of *Hemerocallis graminea*, Andr. (*H. minor*, Mill.), and of *Lilium bulbiferum*, Linn., are used by the Chinese for flavouring soups and also eaten as a vegetable, and the bulbs of *Lilium cordifolium*, Thunb., are used as food in Japan and by the Ainos (*K.B.* 1889, pp. 116-118).

Asparagus officinalis, Linn.; Asparagus.

A perennial with creeping rootstocks, commonly cultivated in gardens for the young and tender shoots used as a vegetable. The home-grown supplies are augmented from Paris and Southern France.

2. June, 1906, "The Cultivation of Asparagus in Brunswick," pp. 154-159; Oct., 1911, "Commercial Asparagus Cultivation," pp. 551-557.

PALMEAE.

Phoenix dactylifera, Linn.; Date Palm.

A tree, 40 to 80 ft. high, sometimes reaching 100 ft. common in Southern Europe, North Africa, and the Orient, including many varieties; cultivated in India, Baluchistan, California, Arizona, Texas, Australia, Canary Islands, and many hot, dry countries. In desert regions like that of the Sahara in Northern Africa, the fruit is of first importance to the inhabitants. In Mesopotamia as well as being of importance to the people, dates are largely used for feeding cows.

Dried dates are imported into the United Kingdom from Turkey in Asia, France, British India, Persia, Egypt, Gibraltar, &c., the amount in 1913 being 625,866 centals.

1. 1895, "Date Cultivation in South Australia," pp. 161-162; 1896, "Date Cultivation in Antigua," pp. 26-28; 1898, "Date Production in Bussorah," pp. 46-50; 1908, "Cultivation of the Date Palm in Mesopotamia," pp. 283-286; 1914, "The Sex of Date Palm Seedlings," pp. 159-162.

Metroxylon Sagu, *Rottb.*; Spineless Sago Palm, of the East Indies, common in Sumatra and adjacent islands and in Borneo.

M. Rumphii, *Mart.*; Thorny Sago Palm, of New Guinea, Moluccas, and Amboyna, and in Borneo.

Both palms are felled to extract the starch, known as "Sago" from the trunk. The first mentioned is the principal source of the "Sago" that is imported into Europe. The cultivation of the Sago Palms appears to be limited to their native habitats.

1. 1894, "Sago Cultivation in North Borneo," pp. 414-417.

Elaeis guineensis, *Jacq.*; Oil Palm, African Oil Palm.

A tree upwards of 100 ft. high, native of West Africa; introduced to Labuan, Federated Malay States, Seychelles, Sumatra, Queensland, Jamaica, &c. Oil is obtained from the pericarp of the fruit, used for food in West Africa, "palm oil chop" being a standard dish. The kernels are shipped to Europe for crushing; they yield an oil used in much the same way as that of the "Coconut," in the manufacture of margarine, &c., and the

residual cake is an important feeding stuff for stock. The imports of palm kernels into the United Kingdom in 1913 amounted to 1,675,453 centals, coming chiefly from Nigeria (1132835), the remainder from Sierra Leone, Gold Coast, Gambia, Liberia, Cameroons, Togoland, Belgian Congo, French and Portuguese West Africa.

1. 1889, "Oil Palm in Labuan," pp. 259-267; 1891, "African Oil Palm," pp. 190-192; 1892, "Lagos Palm Oil," pp. 200-208; 1909, "The Varieties of the Oil Palm in West Africa," pp. 33-49; "The Economic Aspects of the Oil Palm," pp. 161-184; 1914, "The Varieties of Oil Palm in West Africa," pp. 285-288; 1918, "The West African Oil Palm," pp. 121-124; "The Oil Palm in the Cameroons," pp. 197-198.

2. Nov. 1914, "Palm Nut Kernel Cake," pp. 697-701; Jan. 1916, *ibid.*, pp. 998-1001; July, 1916, "The Influence of Palm Kernel Cake on the Production of Milk and Butter," pp. 305-320; "Palm Kernels and Palm Kernel Cake," pp. 363-366; Nov. 1916, "Palm Kernel Cake," pp. 734-749; Dec. 1916, "Palm Kernel Cake and Meal as Food for Pigs," pp. 850-859.

3a. No. 20, 1917, "Coconut Cake and Palm Kernel Cake."

Cocos nucifera, Linn.; Cocoa- or Coco-Nut.

A tree 60 to 100 ft. high, widely distributed in tropical countries near the sea.

"Cocoa-nut butter" is an edible fat prepared from the Copra or kernel of the nut and refined oil or solid fat is very largely used in the preparation of margarine and other food-stuffs. The cake ("Poonac" in Ceylon) is an important cattle food.

Copra to the amount of 691,443 centals was imported in 1913, chiefly from Australia and New Zealand (the produce of the South Sea Islands), Straits Settlements and Federated Malay States, Philippine Islands and Guam, French Possessions in the Pacific, Dutch East Indies, Mauritius, Portuguese East Africa, Fiji Islands, &c., and nearly double the above quantity of oil, refined and unrefined, came from Germany, Denmark, Ceylon, Australia, France, Belgium, Holland, United States, &c.

1. 1890, "Cocoa-nut Butter (*Cocos nucifera*)," pp. 230-238.

2. June, 1901, "Cocoa-nut Butter," pp. 101-102; Feb. 1915, "Cocoa Nut Cake and Palm Nut Kernel Cake," pp. 1025-1032; May, 1916, "Feeding Coco-nut Cake on Grass," pp. 117-123.

3a. No. 20, 1917, "Coco-nut Cake and Palm Kernel Cake."

The "Palmyra" or "Black Run Palm" (*Borassus flabellifer*, Linn.), a tall palm, native of Tropical Africa, cultivated in India, Burma and Ceylon for the extraction of "toddy," from which the spirit "arrack" is distilled; the "Nipa" (*Nipa fruticans*, Wurmbr.), a low-branched palm found in the Sundribuns of India and in swampy regions of Malaya, Ceylon, Australia, &c.; is an important source of potable alcohol in the Philippines, and the "Wine Palms" (*Raphia vinifera*, Beauv. and *R. Hookeri*, Mann.), of West Africa also yield a beverage called "Palm Wine," everywhere consumed by the natives. The "Chilian" or "Coquito" Palm (*Jubaea spectabilis*, H. B. & K.), yields a honey from the sap of the trunk; the kernels are

edible and are made into confectionery (K.B. 1906, p. 175). The refuse of the "Vegetable Ivory Nut Palm" (*Phytelephas macrocarpa*, Ruiz. & Pav.), of Central America and New Grenada, commonly imported for making buttons, &c., has been recently recommended, ground into meal for feeding stock (Inter. Rev. Sci. & Pract. Agric., Rome, March, 1917, pp. 406-409). The kernels of the "Cohune" Palm (*Attalea Cohune*, Mart.), of Honduras, Guatemala, &c., yield an oil similar to that of the "Coco-nut," and it has been suggested for similar uses.

AROIDEAE.

Colocasia Antiquorum, Schott; Coco Yam (West Africa), Taro (Pacific Isles), Eddo, Dasheen, Tania or Tanier (West Indies), Malanga (Cuba), Yautia Malanga (Porto Rico).

A perennial, commonly grown in tropical countries for the tuberous roots; an important food—eaten like yams (*Dioscorea*) or potatoes—of the natives everywhere. As "Dasheens" the corms are cultivated in the Southern United States as a substitute for potatoes and under the name "Malanga" are brought from Cuba to Tampa, Florida, for the Latin-American people of that city. "Taros" are also shipped from China to America, where they are sold in Chinese shops as "China Potatoes" (Bull. Dept. Agric. Trinidad, Part 1, 1918, pp. 29-39).

The "Yautia" (*Xanthosoma sagittifolium*, Schott) is cultivated in Tropical America, Porto Rico, &c., for the roots for food, used like those of the foregoing.

Arum italicum, Mill., a native of Britain, is cultivated in the Channel Islands for the Arrowroot obtained from the roots, and the common "Cuckoo Pint" (*Arum maculatum*, Linn.) yields a starch from the tubers, known as "Portland Arrowroot." The tubers of *Amorphophallus campanulatus*, Blume, contain a large quantity of starch and are cultivated for food—eaten like yams—in India (Mus. Kew).

ALGAE.

Eucheuma papulosa, Cotton & Yendo; Japanese Seaweed, Tosaka Nori, Crimson Weed or Hong-tsay (China).

A seaweed found in the Red Sea, off Somaliland, Formosa, Japan, and Sandwich Islands. In Japan "the collected weed is dried in the sun and sold in the markets, where several varieties, according to the colour, substance, and shape, are distinguished by dealers; it is prepared into isinglass and is used as food."

1. 1914, "The Japanese Seaweed Tosaki Nori," pp. 219-222.

Several other species of Algae are used as food, among which may be mentioned "Jelly Weed" (*Eucheuma speciosa*, J. Ag.), a gelatinous seaweed found on the coast of Western Australia, where it is collected and used for making jelly. The "Kombu" or "Kobi" (*Laminaria longissima*, Miyab., *japonica*, Aresch., and other species) is prepared for food in Japan and "Nori" (*Porphyra vulgaris*, Ag.), common around the coasts of Japan, is collected there, and also cultivated for food "by placing

branches of trees in the mud of the sea" (Useful Pl. Japan (Agric Soc., Japan, Tokyo), 1895, p. 37); or "slender bushy twigs are planted in regular rows in shallow and brackish water, enough space being left between the rows to permit the passage of canoes" (Postelsia, Minnesota, 1901, p. 9); also common on the coasts of Britain, as "Laver" it has been sold in Swansea for making a kind of bread (Mus. Kew) and in other parts of the British Isles is commonly collected and used as a vegetable. "Ceylon Moss" (*Gracilaria lichenoides*, J. Ag.), found on rocks in the Indian and Malayan Seas, is collected and made into jelly. "Carrageen Moss" or "Irish Moss" (*Chondrus crispus*, Lyngb.), abundant on the rocky coasts of Britain, is collected in Scotland and Ireland for cattle feeding, and it has been used recently in hospitals as a substitute for Isinglass. "Tengusa" (*Gelidium* spp.) is used after special preparation for food in Japan, where it is manufactured into "Agar-agar," "Kanten," or "Japanese Isinglass."

It is convenient here to mention the *Lichens*—"Reindeer Moss" (*Cladonia rangiferina*, Hoff.), common on heaths in sub-alpine, alpine and cold regions, a winter food for reindeer in Lapland; "Iceland Moss" (*Cetraria islandica*, Ach.), of the frigid zones, used for food, and *Lecanora esculenta*, Eversm., the "Manna" of the Bible, common in Persia, deserts of the East and North Africa, often forming drifts several inches deep in valleys and collected by the inhabitants for food (Mus. Kew).

FUNGI.

Agaricus campestris, Linn.; Common Mushroom.

Abundant in fields in Europe and cultivated in Paris and at home for market—a well-known esculent.

2. June, 1896, "The Mushroom Industry of Paris," p. 59; Jan. 1906, "Mushroom Spawn Making," pp. 592-596; Feb. to June, 1910, "Edible and Poisonous Fungi," with coloured plates (issued in pamphlet form); April, 1913, "The Cultivation of the Mushroom," pp. 30-33; July, 1917, "The Nutritive Value of Edible Fungi," pp. 416-419.

3. No. 276, 1914, "The Cultivation of the Mushroom."

Hirneola polytricha, Mont.; Jew's Ear Fungus.

A fungus found on wood in New Zealand, India, Java, &c. Large quantities are exported from New Zealand to China, where it is also cultivated for food.

1. 1890, "An Edible Fungus of New Zealand," pp. 217-220.

Tuber aestivum, Vitt.; **T. melanosporum**, Vitt.; Truffles.

A tuberous-like fungus included in *Ascomycetes*, found a few inches underground in Oak, Elm, and Ash forests, the first-mentioned in England—Hampshire, Kent, Sussex and Wiltshire—and the latter in the warmer parts of France and Germany. Perigord in France is the most important source of supply to the United Kingdom; the truffles are found by pigs specially trained for the purpose.

Tuber indicum, Cooke & Mass., is eaten by the Natives in the Himalayas. *Morchella esculenta*, Linn., is found amongst grass in Europe and Asia, commonly eaten and well-known in the markets as "Morel." *Cyttaria Darwinii*, Berk., a fungus parasitic on "Evergreen Beeches" (*Nothofagus betuloides*, Blume), in Tierra del Fuego, where it affords for several months the staple food of the inhabitants. *Cytarria Gunnii*, Berk., of Tasmania, and *C. Berteroi*, Berk., of Chile are also eaten in their respective countries. Darwin says (Voy. "Beagle," p. 85) of the *Cytarria* in Tierra del Fuego that "the fungus in its tough and mature state is collected in large quantities by the women and children and is eaten uncooked," and that "with the exception of a few berries, chiefly of a dwarf *Arbutus*, the natives eat no vegetable food beside this fungus." The "Fairy Ring Champignon" (*Marasmius oreades*, Fr.), so named because of its habit of growing in rings on lawns and in old pastures, is a familiar esculent.

There are many more Fungi and Algae that could be mentioned as edible, and so also many more plants among the Phanerogams above recorded, but the mere enumeration of them would extend the list out of all proportion to their value; the more important it is believed are all included, and of these there is perhaps scarcely a subject on which an extensive article, pamphlet, or even a book, might not be written. A few that are singular in Orders not prominent for their food value may be referred to as:

Rhamneae, "Indian Jujube" or "Chinese Date" (*Zizyphus Jujuba*, Lam.), fruit preserved in syrup, an important food in China and other eastern countries; fruits are also often dried, and they have occasionally come into the London market.

Caryophyllaceae.—"Spurrey" (*Spergula arvensis*, Linn.), a common weed of Europe, grown in Belgium as a forage crop for sheep (see Journ. Bd. Agric., "Spurrey as a Forage Crop on Sandy Soils," March, 1912, pp. 1020-1024, and June, 1912, pp. 214-215).

Bixineae.—"Madagascar Plum" (*Flacourtia Ramontschi*, L'Herit.), of Tropical Africa and India; fruits eaten raw or cooked, leaves used as cattle fodder in India. "Kei Apple" (*Aberia Caffra*, Harv. & Sond.), of South Africa; fruits pickled or otherwise preserved.

Portulacaceae.—"Purslane" or "Pig-weed" (*Portulaca oleracea*, Linn.), a common weed in India, Africa, Australia and America; may be used as a pot-herb or vegetable, and the seeds are largely used for food by the natives of Australia (Maiden).

Proteaceae.—"Queensland Nut" (*Macadamia ternifolia*, F. Muell.), of Eastern Australia; "Wild Almond" (*Brabejum stellatum*, Thb.), of South Africa; and "Avellano" or "Guevuin" (*Gevuina Avellana*, Mol.), of Chile; all have edible seeds.

Elaeagnaceae.—“Trebizonde Date” (*Elaeagnus orientalis*, Linn.), of the Orient; fruits eaten.

Araliaceae.—“Udo” (*Aralia cordata*, Thunb.), cultivated in Japan, in gardens and fields for the root and young shoots as a vegetable.

Coniferaeae.—“Pignon” or “Stone Pine” (*Pinus Pinea*, Linn.); seeds sold for food in the markets of Lisbon. “Bunya-Bunya” Pine (*Araucaria Bidwilli*, Hook.), Queensland; seeds an important source of food of the aborigines of Moreton Bay.

Gingkoaceae.—“Maiden Hair Tree” (*Gingko biloba*, Linn.); kernels edible; sold in most market-towns of China (“Trees of Great Britain and Ireland,” Elwes & Henry, i. p. 56).

Cyperaceae.—“Nut Grass,” “Tiger Nut,” “Chufa” or “Zulu Nut” (*Cyperus esculentus*, Linn.), a common weed in Southern Europe, Tropical and South Africa, in America and other warm countries; tuberous roots eaten, sometimes seen in shops of this country; bulbs roasted and eaten in Damara-land” (Fl. Trop. Afr. viii. p. 356), and other species.

Filices.—“Bracken” (*Pteris Aquilina*, Linn.), wild in many temperate countries; root-stocks and young fronds ground into meal, suggested for feeding pigs and poultry (see Journ. Bd. Agric. March, 1917, pp. 1252-1255); a farinaceous food has been obtained from the rhizomes for use as food in Britain in times of scarcity, and there is, in the Museum at Kew, a sample of meal prepared from the same, used as food in Japan, also rhizomes under the name “aruhe,” stated to be formerly roasted and eaten by the natives of New Zealand. In general, as a famine food or substitute for better things, this plant would appear to be one of the commonest; Darwin observes (l.c.) that “in New Zealand, before the introduction of the potato, the roots of the fern were largely consumed.”

Further particulars of these plants and others of like value, together with those of first importance, will be found in the following works, the list, it is desirable to add, not being submitted as exhaustive:—

Kew Bulletin.—“Colonial Fruit,” Nov., 1887, pp. 1-20; 1888, pp. 1-23, pp. 177-252. “The Fruits of Mysore,” 1889, pp. 21-28. “Cold Storage of Fruit,” 1894, pp. 187-189; 1896, pp. 33-36. “Cultivation of Vegetables,” 1894, pp. 219-223; 1895, pp. 307-315. “Fruit Growing at the Cape,” 1897, pp. 191-199. “Famine Plants in Zululand,” 1898, pp. 51-54. “Australian Pasture Herbs,” 1909, pp. 12-16. “Cold Storage of Fruit and Vegetables,” 1914, pp. 11-16. “Notes on Fruit Growing in the East Africa Protectorate,” 1914, pp. 268-273. “The Economic Properties of some Hardy Ornamental Fruits,” 1914, pp. 339-345.

“The Useful Plants of Great Britain,” C. P. Johnson & J. E.

Sowerby, pp. 1-324, illustrated, col. plates (Robert Hardwicke, London).

"Food Grains of India," A. H. Church, pp. 1-180, illustrated (Chapman & Hall, Ltd., London, 1886); Suppl. pp. 1-23 (1901).

"Human Foods and Food Adjuncts" and "Forage Plants," pp. 1-144 in "Useful Native Plants of Australia," J. H. Maiden (Trübner & Co., London, and Turner & Henderson, Sydney, 1889).

"Famine Foods" in "Dict. Economic Products of India," G. Watt, vol. iii. (1890), pp. 313-320. "Food and Fodder," J. F. Duthie, *ibid.*, pp. 407-437. "Camel Fodders," *ibid.*, ii. (1889), pp. 58-63.

"The Forage Plants of Australia," F. Turner, pp. 1-94, illustrated (Govt. Printer, N.S. Wales, 1891).

"The Fruit Growers' Guide," J. Wright, vols. i.-iii; 46 col. plates (J. S. Virtue & Co., Ltd., London, 1892).

"Permanent and Temporary Pastures," M. J. Sutton, illustrated, pp. 1-204 (Simpkin, Marshall, Hamilton, Kent & Co., Ltd., London, 1895).

"Vegetables" in "Vegetables & Flowers from Seeds in Tropical, Semi-tropical, and Temperate Climates," Sutton & Sons, pp. 1-131.

"A Report upon the Forage Plants and Forage Resources of the Gulf States," S. M. Tracy, U.S. Dept. of Agric. Division of Agrostology, Bull. No. 15, 1898, pp. 1-55, illustrated.

"Fodder and Forage Plants: Exclusive of the Grasses," J. G. Smith, U.S. Dept. of Agric. Div. of Agrost. Bull. No. 2, 1900, pp. 1-86, illustrated.

"A Note on the Plants used for Food during Famine and Seasons of Scarcity in the Bombay Presidency," G. A. Gammie, Records Bot. Survey, India, Vol. ii. (Calcutta, 1902), pp. 171-196.

"Famine Foods," Noel Paton & J. C. Dunlop, including Analyses of Indian Pot-herbs of *Amarantaceae*, *Chenopodiaceae*, and *Polygonaceae*, D. Hooper, The Agricultural Ledger, No. 6, 1904, pp. 37-72.

"Food for the Tropics," T. M. Macknight, pp. 1-116 (W. Thacker & Co., London, 1904).

"Les Plantes Potagères," Vilmorin-Andrieux & Co., pp. 1-804, illustrated (Paris, 1904): English Translation, "The Vegetable Garden," W. Robinson, pp. 1-782, illustrated (John Murray, London, 1905).

"The Commercial Products of India," G. Watt, pp. 1-1189 (John Murray, London, 1908), numerous notes on food plants.

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II.—MISCELLANEOUS NOTES.

SIR EDWARD FRY.—We record with regret the death of the Rt. Hon. Sir Edward Fry, G.C.B., F.R.S., at his house Failand, near Bristol, on 18th October, 1918.

Sir Edward's interest in botany was life-long, beginning with the flowering plants of the neighbourhood of Bristol, where he was born, and ranging in later years over large areas of Cryptogamic botany and over many foreign lands. In his busy years at the Bar and on the Bench, his leisure was small, but he gratified his interest in flowers by growing orchids at Highgate. At Failand, his later home near Bristol, his garden was a source of perennial interest, and among other botanists he entertained here Dr. Asa Gray.

His interest in botany was of a philosophic rather than of a merely systematic nature, and this led him to value all variations

and exceptions; he took special interest in the Pelorias of Yellow Toadflax and Foxglove.

In middle life, finding the English flora fairly familiar to him, he turned his attention to mosses, and later to liverworts and the Mycetozoa, and with the liverworts and Mycetozoa he was materially helped by his daughter Miss Agnes Fry. In spite of somewhat awkward manipulation and eyesight that was not first-rate, he derived an immense amount of pleasure from these studies and from the thoughts they aroused in him, and he never lost sight of the broad questions of life and its nature in the study of detail. Perhaps one of the happiest moments of his botanic life was when *Buxbaumia indusiata* was brought to him in the Jura, and its interest was great for him as an early anticipation of the development of the sporophyte and almost complete suppression of the gametophyte. Another happy moment was when the long desired fructification of *Lunularia cruciata* was found on the crumbling walls of the Forum.

He sometimes complained that modern science was as hopelessly metaphysical as that of the Middle Ages, and wished at times that men of science could be induced to state and argue the debatable matters with all due forms and production of evidence as matters of fact are debated in a court of law.

We are indebted to Miss Agnes Fry for much of the information on which this brief note is based.

HECTOR LÉVEILLÉ. — We learn that Monseigneur Hector Léveillé, Prélat de la Maison de sa Sainteté Pie X, died on November 25th, 1918. He was born at Mons on March 13th, 1863. He went to Pondicherry as Professor of Science and returned to Mons in January, 1892. He was well known as the founder and perpetual secretary of the Académie Internationale de Géographie Botanique, the official organ of which, issued at first under the title of *Le Monde des Plantes* and during recent years as the *Bulletin de Géographie Botanique*, now in its 28th volume, he edited, and to which he copiously contributed. He published numerous papers in other journals, and his studies of the family *Onagraceae* found expression in his *Monographie du Genre Oenothera*, an *Iconographie du Genre Epilobium*, and several smaller works. He was particularly interested in the flora of China, having received collections of plants from French missionaries stationed in various parts of that country, and described—often apparently hurriedly, certainly inadequately—a large number of species which he supposed to be new. He published a *Catalogue des Plantes du Yun-Nan* and issued several other compilations on the flora of China, either hectographed or in manuscript. He was an enthusiastic worker. Monseigneur Léveillé, during the last twelve years, was a frequent correspondent with Kew, and though his contributions to the Herbarium were not considerable, he was ever ready to lend specimens, and in this manner on many occasions rendered assistance to the establishment.

CLAUDE KEITH BANCROFT.—With great regret we have to record the death of Mr. C. K. Bancroft, M.A., F.L.S., who recently resigned the position of Assistant-Director and Government Botanist, British Guiana, owing to ill-health. Mr. Bancroft had been unwell for some time, but had made a good recovery in Canada, where he had gone to recuperate, when he contracted influenza, followed by pneumonia, and died at Toronto on January 11th.

Mr. Bancroft received his early scientific education at Harrison College, Barbados, and in 1905 he won the Barbados Scholarship in natural science (*see* Agric. News, iv., p. 312), and was the first to win a natural science scholarship in the West Indies. Until Sir Daniel Morris was appointed Imperial Commissioner, the Barbados Scholarship was only awarded for proficiency in mathematics or classics. From Harrison College he proceeded to Trinity College, Cambridge, and in due course was elected to a major scholarship at the College, and later was awarded 1st Class Honours in the Natural Sciences Tripos in 1908. After taking the B.A. degree he devoted his attention to botany, and more particularly to mycology and plant pathology, and spent some time working at plant diseases in the Jodrell Laboratory.

In 1910 he was appointed Assistant Mycologist in the Federated Malay States (*K.B.*, 1910, p. 253), where he did much useful work, in recognition of which he was appointed, three years later, Assistant Director and Government Botanist, British Guiana (*K.B.*, 1913, p. 91). Through his untimely death agricultural science has lost a man of good promise, who can ill be spared at the present time.

Additions to Gardens.—Exchanges were difficult owing to the war, as in previous years. Consignments of plants and seeds were lost at sea or were so long on the way as to have been injured beyond recovery. Over 200 entries were made of plants, &c., received, most of these being from British sources. The most noteworthy were the following:—

Botanic Gardens and other institutions:—

Arnold Arboretum.—Seeds of trees and shrubs.

Dominica Botanic Garden.—Tubers of various species of *Dioscorea*, *Alocasia*, &c.

Jamaica Botanic Gardens.—Seeds of *Portlandia*.

Washington, U.S.A., Dept. of Agriculture.—Seeds, various trees, and shrubs.

Giza, Ministry of Agriculture.—Seeds of *Feijoa Sellowiana*.

Nairobi, Forest Dept.—Seeds of *Delphinium candidum*.

Pretoria, Dept. of Agriculture.—*Eucomis* sp., various seeds.

Khartoum, Palace Gardens.—Seeds of *Hyoscyamus muticus*.

Kirstenbosch Botanic Garden.—Seeds of Proteas, &c.

Angola Botanic Garden.—Seeds of *Raphia Sese*, native and other plants.

Uganda, Forestry Dept.—Seeds of various native trees.

Calcutta Royal Botanic Garden.—Seeds of many species of Indian plants.

Dehra Dun Research Institute.—Seeds of trees and shrubs.
Burma Forestry Dept.—Seeds of *Butea minor*.

Hong Kong Botanic Gardens.—Seeds of *Strychnos paniculata*.

Singapore Botanic Garden.—Seeds of *Canarium sp.*, *Parinarium costatum*, *Elaeocarpus Griffithii*, and *Monochoria elata*.

Sydney Botanic Gardens.—Seeds of *Telopea speciosissima*.

Adelaide Botanic Garden.—Seeds of *Macrozamia Macdonnellii* and *Livistona Mariae*.

New Zealand, Government of.—Varieties of *Phormium tenax*.

Glasnevin, Royal Botanic Gardens.—20 species and vars. of *Paeonia*, *Rhododendron burmanicum*.

Edinburgh, Royal Botanic Garden.—*Castanopsis obovata*, *Rhododendrons*, etc.

Cambridge Botanic Gardens.—Seeds, *Columnnia Banksii*, and other plants.

Greenwich Park.—*Meconopsis*, *Primula*, etc.

Receipts from other sources included the following:—

Mr. Burt Davy, Vereeniging, S. Africa.—Seeds, *Jubaeopsis caffra*.

Mr. R. A. Dummer, Uganda.—35 packets of seeds from Mount Elgon.

Mr. A. Gosling, Paraguay.—Seeds of *Ilex paraguayensis*.

Dr. C. V. Perez, Tenerife.—Seeds of *Pinus*, *Cytisus* and *Juniperus*.

Mr. M. T. Dawe, San Lorenzo, Colombia.—Seeds of *Myristica Otoba*, *Mutisia*, etc.

Col. Longe, Norwich.—*Rhododendron carneum*.

Mr. J. C. Williams, Caerhays.—Seeds and plants of many Chinese *Rhododendrons*, *Picea jizzoensis*.

Mr. H. St. George, Coombe House, Kingston.—Collection of Orchids.

Mr. H. J. Elwes, Colesborne.—Pleiones and other Orchids, collection of seeds from China.

Mr. E. J. Esdaile, Taunton.—Large plants of *Eucharis*, *Pancratium*, &c.

Countess Frederick Metaxa, Albany Mansions.—Orchids.

Mr. M. E. G. Young, Halsey Street, S.W.—*Rhododendrons*, Pines and Ferns from Simla.

Mr. W. R. Dykes, Godalming.—Iris.

Mr. Justice Rowlatt, Gloucester Square.—17 packets of seeds from India.

Mrs. Campbell, Stratford-on-Avon.—Large plants of *Trichomanes radicans*.

Sir E. G. Loder, Bart., Leonardslee.—Various trees and seeds, *Picea Breweriana*.

Mr. R. Farrer, Ingleborough, Yorks.—33 species of Chinese trees and shrubs.

Mr. H. A. Wickham.—Seeds of *Caryocar villosum*.

The Hon. Vicary Gibbs, Aldenham House.—Various trees and shrubs.

Mr. W. A. Milner, Totley Hall.—*Primula Reidii*.

Mr. H. C. Baker, Bayfordbury.—Seeds of *Fokienia Hodgkinsii*.

Mr. C. Eley, East Bergholt.—*Pterostyrax hispida* and seeds of *Rhododendrons*.

Mr. G. H. Johnstone, Ladock.—Various seeds from Palestine.

Lady Hanbury, La Mortola.—Seeds of *Jubaea spectabilis*, *Agaves*, &c.

Prof. A. Henry, Dublin.—Seeds of Macedonian Plane.

Lt.-Col. Borton, Maidstone.—Iris and various seeds from Palestine.

Mrs. Woodward, Arley Castle.—*Daphne tangutica*.

Among the purchases made were orchids for the collection and many kinds of seeds from prize ships sold by auction under Admiralty instructions.

Plants and seeds were distributed to Botanic Gardens and to regular correspondents, including collections of choice trees and shrubs to the following: Lt.-Col. F. R. S. Balfour, Dawyck; Mr. E. R. Pratt, Ryston Hall; Mr. C. Eley, East Bergholt; Mr. R. Farrer, Ingleborough; Mr. P. D. Williams, Lanarth; and Miss E. Willmott, Warley Place. Trees, shrubs, and herbaceous perennials were supplied to various military stations for the purpose of adding a cheerful note to their surroundings. A large quantity of cuttings of three Poplars, namely, *P. Eugenei*, *P. regenerata*, and *P. scrotina* were supplied to H.M. Commissioner of Woods at Northampton. A large number of young trees of Canadian Maples, raised at Kew from seeds obtained from Canada, were supplied for the Canadian cemeteries in France.

The number of packets of seeds distributed was 2,200 in 88 consignments. The number of packages of plants distributed was 70.

Vegetables were again grown in most of the flower beds, including the parterre in front of the Palm House, which was planted with onions, and about $2\frac{1}{2}$ acres of lawn in front of Kew Palace which was ploughed and planted with British Queen Potatoes.

Arboretum.—The labour situation has not permitted of the undertaking of any notable alterations during 1918, and the chief work during the year has been the routine work of maintaining the collections in as good a condition as possible. The most difficult problem to solve—not easy even in normal times—has been the overcrowding of trees and shrubs, owing very much to the great access of new material from China and elsewhere in the years before the war. With shrubs especially, it is rarely possible to allot sufficient space for the full development of young plants at the time they are put out.

During the last weeks of the year a considerable amount of thinning out and replanting was done in the *Rhododendron* Dell, and the opportunity was taken to make a wide grassy opening on the side nearest the Thames so that the visitors who find

themselves on that side of the Dell may be provided with a way into it, without having to walk to either end, or, as more frequently happened when the rhododendrons were in flower, crush their way through the bushes down the slope to the walk below.

The collection of willows has so largely increased that it has lately been quite impossible to find room for them round the margins of the lake—the original site allotted to them—without completely clothing its banks. Some years ago the collection was in consequence extended into the adjoining portion of the Queen's Cottage Grounds. This is the best position now available for them from a cultural point of view, as it is near the river and the soil is fairly good. By removing another of the plantations of nondescript trees, additional space has this winter been provided to extend the *Salix* collection there.

No storm of exceptional violence passed over Kew during the year and no loss of famous trees has to be reported. But during the summer a tree of *Hippophae salicifolia*, an ally of our native sea-buckthorn, probably the finest in the kingdom, was struck by lightning and its trunk partially stripped of bark. Judging, however, by its appearance during the autumn it seems likely to recover. In December, during a short squall, a big specimen of "crack" willow, *Salix fragilis*, at the south-east end of the lake, was blown down.

An interesting event in the grounds was the copious blossoming of many of the trees of *Davidia involucrata* in May and the subsequent development of a sufficient quantity of seeds to enable us to offer them for distribution in the annual seed list for the first time. This tree, about which so much has been written and so many expectations have centred, may now be regarded as definitely established in the British Isles. It may be worth while to mention here, in order to avoid possible disappointment and the premature throwing away of seeds that may be distributed, that they sometimes lie dormant two or even three years before germinating.

Valuable contributions of hardy trees and shrubs were made by Mr. Reginald Farrer (Chinese species), Mr. J. C. Williams (rhododendrons, &c.), The Hon. Vicary Gibbs (miscellaneous), and Mr. R. C. Notcutt (cistuses, etc.).

The following new rhododendrons flowered:—*R. Houlstoni*, Hems. & Wils., *R. lucidum*, Franch., *R. neriiflorum*, Franch., *R. oleifolium*, Franch., *R. rupicolum*, W. W. Smith, *R. scintillans*, Balf. et W. W. Smith, *R. sulphureum*, Franch., and *R. trichocladum*, Franch.

Perhaps the most interesting of recent additions to the Arboretum is *Nothofagus Dombeyi*. Since the re-introduction of *N. antarctica* and *N. obliqua* by Mr. H. J. Elwes in 1902, a great interest has sprung up among tree-lovers in the 'beeches' of the southern hemisphere. So far as we know, *N. Dombeyi* has never before been introduced alive to this country. After several unsuccessful attempts its introduction has been successfully accomplished through the efforts of Lieut.-Col. F. R. S. Balfour. In August, 1917, a package of several hundreds of seeds was received by him from Chile which he presented to

Kew. Most of them were dead and four seeds only germinated. but the young plants survived the winter and grew vigorously during the summer of 1918. *N. Dombeyi* is known to the Chileans as "Coigue" and is described by Mr. Elwes as a "fine beech, very abundant in the forests of the western slopes of the Andes up to about 5000-6000 ft. altitude in the neighbourhood of the Baths of Chillan." As *N. antarctica* grows in the same region at similar altitudes, one might conclude that *N. Dombeyi* ought to be as hardy as that species. It is, however, evergreen, a character which is often correlated with greater tenderness. The plants at Kew have been protected so far, but it is intended to try them in the open ground next spring. Mr. Elwes found trees below the Baths of Chillan with trunks 22 to 27 ft. in girth at 5 ft. from ground-level.

Museums.—The record for the past year is practically the same as for 1917. Additions to the collections have not been numerous and but few duplicates have been available for distribution. The staff has been fully occupied in dealing with a considerable number of varied vegetable products received from Government Departments, commercial firms, &c., for identification, and much general information bearing upon the products has been supplied.

Although details cannot be given, it should be recorded that many of the subjects dealt with have been of a confidential nature, and in this direction the museum records and collections have been fully utilised.

In several directions the permanent collections have been improved and the re-labelling in Museum No. 1 has gone on steadily. The release of two additional museum porters from the Army during the year has now made it possible for all the museums to be re-opened to the public. J. M. H.

Research in Jodrell Laboratory in 1918.—Mr. J. Bintner made some further observations on the development of callus-tissue and the formation of roots in cuttings.

Mr. L. A. Boodle continued the study of some developmental stages of the ovule of *Typhonodorum*, and carried out other anatomical investigations.

Miss M. S. G. Breeze examined the pollen of several plants in relation to the sterility of certain hybrids, &c.

Mr. W. C. Worsdell completed his anatomical study of the *Compositae*, and continued that of some other families.

Pathological Laboratory.—On account of the decision to separate the Board's administrative and advisory work from research, there was a tendency in 1918 for workers to confine themselves to one or other aspect of the work, though at the same time the advantages to be gained from the blending of the research and applied aspects of pathology prevented this from being exclusively the case.

With regard to the administrative side a special attempt was made to develop the Intelligence Service inaugurated last year and to obtain an idea of the plant disease situation in the country as a whole. On the research side work on problems of general importance was continued, and investigation carried out on the biology of several important parasitic fungi. As in previous years the routine duties of the laboratory interfered with experiments and research, but on the whole the various branches of pathological work were carried out successfully.

This report deals exclusively with the mycological side of the work carried out in the Laboratory. The Board's entomological staff have also worked in the same building and throughout the year the closest co-operation has been maintained between the workers in these two branches of plant-pathology.

Staff.—In connection with the approaching changes, several alterations took place with regard to the staff. Mr. W. B. Brierley commenced work at the Phytopathological Institute at Rothamsted on November 18th, and on the same day Mr. A. D. Cotton and Mrs. N. L. Alcock were transferred to the staff of the Board of Agriculture. Miss M. N. Owen also left the laboratory in October to take up work in the Department of Technical and Industrial Research, and Mr. R. Beer was appointed temporary technical assistant.

Intelligence Service.—The Plant Disease Survey (including both animal and fungus pests) was instituted last year by the Plant Disease Sub-Committee of the Food Production Department. By means of a system of monthly reports prepared by specially qualified honorary correspondents in all parts of the country, a very large amount of information was gathered. Further data were acquired by means of visits, circular letters, and special enquiries. In this way it has been possible to obtain a more accurate and detailed idea than has ever been obtained before of the incidence of disease in the country. The work of collating reports and of preparing summaries of the fungus diseases has been largely entrusted to Miss M. G. Aikman, and the report for the season will shortly be published.

Diseases.—With regard to noteworthy fungus diseases in the year 1918, the following may be mentioned. Amongst cereals a rather bad attack of Yellow Rust of Wheat (*Puccinia glumarum*) occurred throughout a very large part of the country during the early part of the season. This was in striking contrast to the previous year, when Yellow Rust was practically absent. In the eastern counties especially the attack was severe, and even resistant varieties such as "Little Joss" suffered to some extent. Much of the wheat, however, outgrew the disease as the season advanced, but in many cases the plants suffered considerably. An attempt was made to determine the susceptibility of the different varieties in different localities. Wheat Mildew was also prevalent in certain districts in July and August, especially where nitrogenous manures, such as sulphate of ammonia, had been applied freely.

Fruit suffered perhaps less from fungus diseases than usual. The distribution of American Gooseberry Mildew, which in 1917 was extremely limited, increased materially, and, as was to be expected, radiated out from the centres where it had occurred that year.

Another contrast was found in the case of Black Currant Rust (*Cronartium ribicola*), the general occurrence and abundance of which, in 1917, was phenomenal. In 1918 the rust, except when in immediate proximity to diseased Weymouth pine (its alternate host), was absent. In autumn the disease spread somewhat in a few localities, but probably in all cases starting from the infected pine centres.

With regard to vegetables, during spring damping-off of seedling tomatoes through a species of *Phytophthora* caused still further damage. Sterilisation of soil and the use of non-contaminated water have proved successful as control-measures. A leaf-blotch in cucumber, due to *Colletotrichum oligochaetum*, was estimated to cause a loss of several thousand pounds in Hertfordshire, in which county also Sleeping Disease of tomatoes is still very prevalent, destroying many thousands of plants.

Onion Diseases.—Onions received special attention. The Sclerotium disease, which has been under research for more than a year, proved very destructive last season and was discovered to exist in practically all parts of England. It was observed at Kew to attack shallots which hitherto were regarded as being immune (see under "Research," p. 96). Another serious and new disease, viz., Onion Smut (*Urocystis Cepulae*), occurred in two districts (Northamptonshire and Northumberland). This fungus is the cause of much damage in the United States; it occurs also on the continent of Europe. Although no published record of the presence of Onion Smut in Britain exists it was ascertained that the disease appeared near Edinburgh seven years ago but has been stamped out. The fungus has again established itself in Britain (probably being re-introduced with the seed), and every effort is being made to exterminate it.

ADVISORY WORK.

Advisory work covered a large range of diseases and was particularly heavy in late spring and early summer. Owing to all questions relating to potato diseases being dealt with by the Food Production Department, the laboratory was relieved of at least 500 enquiries with regard to this crop. The number of enquiries dealt with was 730. Although most of these were answered by means of correspondence, in several cases visits were paid with profitable results. Some fifty visits to all parts of the country were paid during the course of the season. Some of the more important cases were Yellow Rust in Wheat, Failure of Oats, Barley Stripe, Wart Disease of Potato, Potato Black-leg, Apple Mildew, Apple Canker, Weymouth Pine Blister Rust, Sclerotium Disease of Onion, and the newly-introduced Onion Smut.

Special visits were paid to a large number of orchards in the

West of England in connection with the extensive damage caused by Silver Leaf. The method of infection, effect of soil-conditions, and especially the question of stocks, were studied in the field. All the most recent researches, both in the orchard and in the laboratory, tend to confirm the view that the disease in the vast majority of cases is caused by *Stereum purpureum*, which gains entrance to the tree through wounds. A lecture was given at Worcester and also demonstrations showing method of infection and destruction of the trees by the attacking fungus.

Technical advice has also been supplied to the Horticultural, Technical, and Supplies Divisions of the Food Production Department, and also to the Seed Testing Station of the Board of Agriculture and Fisheries with regard to various fungi affecting particularly seed wheat. Some sixty samples of the latter have been received for investigation. Amongst the fungi found is an interesting Pyrenomycete, the development of which is being investigated by Mrs. Alcock.

II. RESEARCH.

Botrytis.—The investigation of *Botrytis cinerea* by Mr. W. B. Brierley was continued. The work developed along two main lines. In the first of these, a study of the behaviour of the fungus in the tissues of various hosts, it was ascertained that under certain conditions the hyphae may absorb their cell-walls and exist in a free plasmodial state, the fungus passing thus from cell to cell through the pits in the walls.

The second line of work has been the investigation of the variability and specific constancy of the morphological and physiological characters of the fungus when growing under exactly controlled environmental conditions. A very great amount of data has been obtained, but the investigation is still far from complete. It is clear, however, that *B. cinerea*, is not a single species, but an aggregation of numerous elementary species; the morphological characters of any particular culture or growth of this fungus being a direct resultant of two factors, viz., the elementary species and the host or culture medium. Within certain limits, therefore, the morphological characters of specific value of the fungus are under the control of the investigator, and may be changed at will.

Rose Blotch Fungus.—The life-history of the Rose Blotch fungus was investigated by Mrs. Alcock and a new method of hibernation similar to that which occurs in Apple and Pear Scab was discovered. The results were published in the *Bulletin* (1918, p. 193).

Onion Disease.—In conjunction with Miss Owen, research on the biology of the onion Sclerotium disease was continued. The name *Sclerotinia bulborum*, under which the disease has recently passed, was found to be incorrect, the fungus in reality being *Sclerotium cepivorum*, Berkeley. The parasite was shown to attack the plant by means of the roots and to spread upwards to the base of the bulb. It forms both spores and sclerotia on the

bulbs in the soil, and although it has been grown for fifteen months in pure culture, no signs of an ascigerous stage (the spores of which would, under natural conditions, presumably be air-borne) has developed. Garden sanitation, rotation of crops, and the use of soil fungicides, are therefore required for its control. It is hoped to publish results in the spring.

Potato Disease.—Miss Owen continued her investigation on Skin Spot of the potato. The fungus was isolated and shown to be quite distinct from *Spicaria*, where it had been previously placed. From reports received through the Plant Disease Survey the disease was found to develop very widely during the winter of 1917-18 on many varieties, and is apparently increasing in abundance. The fungus, however, does not succeed in reaching the inner part of the tuber, being kept to the surface layers by the repeated formation of layers of wound-cork by the potato plant. A paper on the subject will be published shortly.

THE EXPERIMENTAL GROUND.

A further portion of the ground was laid out in 1918 and replanted with young fruit trees. A large part was again kept under potatoes, and a variety of vegetables was grown for experimental purposes. A 10-rod "allotment plot" was marked out and planted in order to obtain exact figures of the yield, in connection with statistics for the allotment movement.

In addition to the work on fungus diseases, a portion of the ground was used by the Entomologist of the Board of Agriculture for Frit Fly experiments, and for the testing of insecticides on various fruit trees.

Of the fungus diseases, mention may be made of the following:—

Black Currant Rust.—With a view to testing the theory of hibernating mycelium, 200 young bushes of black currant, very badly affected with *Cronartium ribicola*, were purchased in the autumn of 1917. No support for the theory was obtained. The growth made by these bushes in the spring was clean and showed no signs of any rust pustules, and microscopic examination of the buds and twigs, carried out in the laboratory in winter, failed to reveal any trace of mycelium.

Plans had also been made to test the value of spraying mixtures for controlling black currant rust. Spraying experiments were therefore arranged to be carried out on plots in a plantation near Norwich, which was very badly attacked last summer, as well as at Kew. By arrangement with other workers, 1 per cent. Burgundy mixture was selected as a fungicide, Bordeaux mixture and lime sulphur being tested elsewhere. The first spraying was given on the Norwich plots on June 13th, a week or so previous to the time at which an outbreak might be expected. The results of the experiments were, however, negative, since, as mentioned above, there was practically no outbreak of *Cronartium* last season and all the plots remained clean. It was, however, ascertained that 1 per cent. Burgundy mixture caused no leaf injury.

Potatoes.—Several plots were used for experimental work on the research carried out on Skin Spot. Trials also of seed-tubers affected with Sprain and *Verticillium* were also conducted. The spontaneous outbreak of a considerable quantity of the last-named disease in various parts of the ground provided copious material for the commencement of research.

Onions.—Extensive preparations were made for work on onion diseases, especially *Sclerotium cepivorum*, but no general and uniform infection could be brought about. Observations were therefore made in a neighbouring market-garden, where the disease was abundant.

Wheat.—A spontaneous outbreak of yellow rust (*Puccinia glumarum*) on wheat sown for Frit Fly experiments is worthy of record.

The following papers were published during the year:—

Diseases of Parsnips (A. D. Cotton), *Kew Bull.*, 1918, p. 8.

The Microconidia of *Botrytis cinerea* (W. B. Brierley), *Kew Bull.*, 1918, p. 129.

Notes on Regeneration in *Botrytis cinerea* (W. B. Brierley), *Annals of Botany*, Oct., 1918.

On the Life History of the Rose Blotch Fungus (N. L. Alcock), *Kew Bull.*, 1918, p. 193, and some ten Board of Agriculture leaflets were rewritten wholly or in part by Mr. A. D. Cotton.

Presentations to the Library during 1918.—War conditions are no doubt the cause of a marked decrease in the number of additions made to the library during the year, whether by purchase or presentation. Many of those received were published some years ago. Several of the periodical or serial publications presented by the Bentham Trustees, altogether about thirty, are or were published in Germany, Austria-Hungary, Russia, and Belgium. Since 1914 none originating in the countries named has reached Kew. The collection of drawings of orchids by Lady Barkly, and of drawings of South African plants by Miss E. B. Barkly, presented by the Bentham Trustees, has been noticed in the *Kew Bulletin*, 1918, p. 342.

Sir William T. Thiselton-Dyer has made several contributions to the library. These include a copy of Collett's *Flora Simlensis*, in which is inserted an original letter to Sir William from the late Lord Roberts, giving some details of Sir Henry Collett's military career; an interleaved copy of Sach's *Text Book of Botany*, translated and annotated by A. W. Bennett and Sir William, containing MS. additions and various original letters and published notes, and bound in four volumes with a copy of the third German edition; an interleaved copy of Pritzel's *Thesaurus Literaturae Botanicae*; Whitaker's *Almanack* from 1870-1917, 48 volumes, a complete set except for the absence of the first issue; and several pamphlets, including the third part of his work *On some Ancient Plant-names*, which appeared in the *Journal of Philology*, vol. xxxiv.

The Director of the Royal Botanic Gardens, Kew, has presented a number of publications including:—*Endemismi ed esodemismi nella Flora Italiana*, by L. Buscalioni & G. Muscatello; *Le Comte Oswald de Kerchove de Denterghem (Notes biographiques)*, by A. Ceuterick; *Bemerkungen über Hasselquist's Herbarium*, by H. O. Juel; and *The Flora of the District of the Thames Valley Drift between Maidenhead and London*, by H. W. Monckton. A copy of a *Flora of Epsom and its neighbourhood*, by T. N. H. Smith-Pearse, has been presented by the Assistant Director.

From Prof. C. S. Sargent has been received a copy of the second volume of the *Catalogue of the Library of the Arnold Arboretum of Harvard University*. This volume contains the subject catalogue, and being compiled from a rich collection of botanical literature it forms a very valuable addition to this particular group of bibliographies and will prove of great usefulness to botanists everywhere.

Dr. N. L. Britton has sent to Kew a copy of his *Flora of Bermuda*, a descriptive and illustrated work (see *Kew Bull.*, 1918, p. 247), and of his *Flora of the American Virgin Islands*, an enumeration of the plants, with localities; he has also presented a further part (vol. xxi. pt. 3, Allioniaceae) of the *North American Flora*.

The series of valuable pomological works issued by the New York Agricultural Experiment Station has been supplemented by a volume on *The Peaches of New York*, by Prof. Hedrick and others, a copy of which has been received from the Director of the Station. A short review of this work appeared in *Kew Bull.*, 1918, p. 160.

Mr. J. H. Maiden is making good progress with his elaborate *Critical Revision of the Genus Eucalyptus*, five parts having reached the library from him during the year. He has also presented a copy of part 2 of the Forestry Handbook of New South Wales, giving his account of some of the principal commercial trees of the State, and a copy of *The Flora of the Northern Territory* [of Australia], by A. J. Ewart and O. B. Davies, to which Mr. Maiden contributed appendices on the genera *Eucalyptus* and *Acacia*. Copies of this work have also been received from Prof. Ewart and the Agent-General for Victoria.

Mr. R. N. Bland has presented several works on the botany of India and the Malayan Peninsula which, though duplicating sets already in the library, will prove of much usefulness, as they are mostly books in constant demand. Amongst them are 4 volumes of Hooker's *Flora of British India*, 20 numbers, partly bound, of King & Gamble's *Materials for a Flora of the Malayan Peninsula*, with th 3 parts on the Monocotyledons by H. N. Ridley, and 4 volumes of the *Agricultural Bulletin of the Straits and Federated Malay States*.

From the Agricultural Adviser to the Government of India a copy of E. J. Butler's *Fungi and Disease in Plants* has been received (see review in *Kew Bull.*, 1918, p. 246); also *Report of the Proceedings of the Second Entomological Meeting held at*

Pusa, . . . edited by T. Bainbrigge Fletcher, and several Bulletins of the Agricultural Research Institute, Pusa.

A brochure entitled *Homenagem ao Prof. Doutor Julio Augusto Henriques*, originally published in *O Instituto*, vol. lxx., and issued in commemoration of this well-known Portuguese botanist's eightieth birthday, has been received from the Faculty of Sciences in Coimbra. On p. 25 there is a description of a new lichen, *Psorotichia Henriquesi*, Sampaio, discovered on Santa Clara Mountains, near Coimbra, where Prof. Henriques, as Professor of Botany in the University and Director of the Botanic Garden, has passed the last fifty years of his life.

In 1917 a collection of 45 letters, written by Dr. F. Welwitsch to the late Prof. Daniel Oliver, was received from Prof. F. W. Oliver (*Kew Bull.*, 1918, p. 45). Last year 25 other letters from the same source were received from him, and also 10 from Allan A. Black to Prof. D. Oliver, written after he left Kew for Bangalore in 1863. Lady Blake has presented the MS. of a *Provisional List of the Flowering Plants of the Bahamas*, by L. J. K. Brace & J. Gardiner, published in the *Proceedings of the Academy of Natural Sciences of Philadelphia*, 1889. She has also presented a copy of the published list, and a copy of Ahern's *Notes on Philippine Woods*.

A *Panoramic Profile of the Hill Ranges of Sikkim*, by H. J. Harman, has been presented by Mr. J. S. Gamble, and a map of Vodena, Macedonia, and of Salonika, by Mr. W. B. Turrill.

The following have been presented by their respective authors or editors:—Pamphlets on the botany of Paraguay, by M. S. Bertoni; *The Marine Algae of the Danish West Indies*, by F. Börgesen, vol. ii., pp. 241-304, and a paper on the mosses and lichens of those islands, by F. Börgesen and C. Raunkiaer; *Relacion de un viaje por el Rio Magdalena*, &c., and the English translation, by M. T. Dawe; *The Flora of the Presidency of Madras*, by J. S. Gamble, part 2, 2 copies, from the author and the Secretary of State for India (see *Kew Bull.*, 1918, pp. 222-228); a set of the numerous leaflets on medicinal and commercial plants, compiled by Mrs. Grieve; *Plantae Thunbergianae*, by H. O. Juel (see *Kew Bull.*, 1918, p. 190); several publications on Italian botany, by C. Massalongo; *Species Blancoanae*, by E. D. Merrill (see *Kew Bull.*, 1918, p. 351); *The Horticultural Note-Book*, ed. 3, by J. C. Newsham; several *Contributions from the Botanical Department of Iowa State College*, by L. H. Pammel and others, from Prof. Pammel; *The Botany of Iceland*, edited by L. Kolderup Rosenvinge and Eug. Warming, part 2; and a number of pamphlets on Queensland botany, by C. T. White.

The more important of the other presentations are:—*Étude de la luminescence du Pseudomonas luminescens*, by A. de Coulson, from Prof. R. Chodat, who has also presented fascicles 1 and 2 of his work *La Végétation du Paraguay*, and several publications of the Botanical Institute of the University of Geneva; *Catalogue des produits de l'Indochine*, tome 1, by Ch. Crevost & Ch. Lemarié, from the Gouvernement Général de Indochine; *Planten-Atlas . . . van Indische Planten, Vruchten*, &c., by Mrs. J. Kloppenburg-Versteegh, from

Mr. H. N. Ridley; pamphlets on plant pathology from the Department of Plant Pathology of the Cornell University Agricultural Experiment Station; six papers on fungi by J. C. Arthur, from the Purdue University; *Transactions of the Third International Congress of Tropical Agriculture*, vol. ii., from the Organising Secretaries; *Sketch of the Natural History of Yarmouth*, by C. J. & James Paget, with a few MS. additions, from Prof. C. S. Sherrington; *A Monograph of the British Lichens*, part 1, second edition, by A. Lorrain Smith, from the Trustees of the British Museum; Bulletins and Circulars of the Agricultural Experiment Station, Cuba, from the Director; *Mededeelingen van het Algemeen Proefstation der Avros*, Medan, Sumatra, from the Director of the Station; *Icones Plantarum Formosanarum*, by B. Hayata, vol. vii., from the Bureau of Productive Industries, Government of Formosa; *Journal of the Botanical Society of South Africa*, parts 1-4, from the Honorary Secretary; *Physiological Abstracts*, vols. i & ii., from the publishers, Messrs. H. K. Lewis & Co.; *Mededeelingen van de Landbouwhoogeschool*, Wageningen, from Prof. J. Ritzema Bos; a large number of the numerous useful publications of the United States Department of Agriculture, from the Secretary of the Department; and a copy of the curious little work by A. Winkler, published under the pseudonym of A. Carex, entitled *Illustrationen zur deutschen Flora in Feder-Zeichnungen*, with *Rand-Glossen*, from Dr. W. Botting Hemsley, who has also contributed, amongst other publications, portions of illustrated works with which to supplement the collection of drawings.

Additions to the Herbarium during 1918.—During the year about 5600 specimens were received as donations or exchanges, 518 were purchased, and 954 were received on loan. The principal collections are enumerated below:—

EUROPE.—*Presented*: Britain (John Divers), by Mr. Jos. J. Divers; Mr. C. E. Salmon. Greek Macedonia, by Capt. G. W. Harris, Sergt. J. M. Russell, and Lce.-Cpl. W. B. Turrill.

INDIA.—*Presented*: Western Himalaya, by Shiv Ram Kashyap. Chitral, Gilgit, and Burma, bequeathed by Major S. M. Toppin. Madras, by the Madras Government Herbarium, through Mr. J. S. Gamble. Andamans, by Mr. C. E. Parkinson, through Mr. R. S. Hole.

MALAYA.—*Presented*: Philippines (C. B. Robinson and others), by Mr. E. D. Merrill. Dutch New Guinea, by Miss L. S. Gibbs.

AUSTRALIA.—*Presented*: Tasmania, by Miss L. S. Gibbs.

NEW ZEALAND.—*Presented*: By Mr. T. F. Cheeseman.

POLYNESIA.—*Presented*: Fiji, by Mr. W. Greenwood.

TROPICAL AFRICA.—*Presented*: Sierra Leone, by Mr. K. G. Burbridge and Major Guy Aylmer. Lagos, by Dr. J. M. Dalziel. Belgian Congo (R. Père Hyac. Vanderyst) by the

Minister of the Belgian Colonies. Uganda and British East Africa, by Mr. J. D. Snowden. Rhodesia, by Mr. F. Eyles. *Purchased*: R. A. Dummer, Uganda.

SOUTH AFRICA.—*Presented*: Transvaal, &c., by Mr. I. B. Pole-Evans.

NORTH AMERICA.—*Presented*: British Columbia, by Miss E. M. Warren. Washington State, by Mr. J. M. Grant.

WEST INDIES.—*Presented*: Dominica, &c., by Mr. W. Fishlock.

SOUTH AMERICA.—*Presented*: Colombia and Venezuela (Arnold and G. Schmidtchen), by Messrs. Sander & Sons.

A detailed list of the specimens collected during the military operations in Macedonia has been published in the *Kew Bulletin*, 1918, pp. 249-341. Plants from the Madras Government Herbarium have been received through Mr. J. S. Gamble, who is working out the *Flora of the Presidency of Madras*. Shiv Ram Kashyap has presented some of the new species of Hepaticae, which he has described in vols. xiii and xiv of the *New Phytologist*. Rawalpindi plants have been collected by Driver T. A. Sprague, a member of the Herbarium Staff, but now on active service. Miss L. S. Gibbs has presented specimens of her Dutch New Guinea collections, which are enumerated in her *Contribution to the Phytogeography and Flora of the Arjak Mountains*, also some of her Tasmanian plants.

Cryptogams from the Philippine Islands have been contributed by Mr. E. D. Merrill. Specimens of new species of New Zealand plants described by Mr. T. F. Cheeseman have been presented by the author. Amongst the collectors in Tropical Africa, who have continued to send specimens, are Mr. J. D. Snowden, of Uganda, Dr. J. M. Dalziel, of Lagos, and Mr. F. Eyles, of Rhodesia. The Minister of the Belgian Colonies have presented the grasses collected in the Belgian Congo region by R. Père Hyac. Vanderyst, and so enabled their determinations to be included in the volume of the *Flora of Tropical Africa*, now in the press. The Uganda specimens purchased from Mr. R. A. Dummer were those collected during the Dummer-Maclennan Expedition to Mount Elgon. Miss E. M. Warren's more recent collections from British Columbia have been made in the neighbourhood of Vernon.

Yews for the State of Georgia.—The Colony of Georgia, now one of the United States of North America, was founded by General James Edward Oglethorpe in 1732. He belonged to an ancient family long settled at Oglethorpe in West Yorkshire, and was an ardent philanthropist and colonizer. He lived for some years in Georgia, nursing the infant colony, returning in 1743 to marry the heiress of Sir Nathan Wright, who brought him a fortune, including Cranham Hall in Essex. Here he lived until his death in 1785. The Hall, now reduced to a farmhouse, is situated on a gentle eminence less than a mile outside

the village of Upminster. Very little of the building of Oglethorpe's time remains, but there are still in existence the old garden walls, with their ancient, wrought-iron entrance gates. There are also a few fine trees of considerable age, especially a specimen of *Fraxinus angustifolia* and one of *F. excelsior heterophylla*. The most conspicuous features of the garden, however, are some very old yew hedges, very bulky and shapeless, but still healthy and regularly clipped. They are thought to be between three hundred and four hundred years old; certainly they were there in Oglethorpe's time.

From its associations with the founder of their State, Cranham Hall is naturally a place of great interest to the people of Georgia, and it is visited every year by a number of pilgrims. In 1916 a request was conveyed to Kew through Mr. H. A. Alexander, from the members of a patriotic and historical society in Atlanta, the capital of Georgia, that cuttings from the old yew hedges should be taken with the view of their being ultimately transplanted to some appropriate place in that city. Kew was very willing to assist in gratifying so pleasing a sentiment, and an officer was sent to Cranham Hall to obtain the cuttings. They were successfully rooted and, after considerable delay owing to circumstances arising from the war, 500 healthy young plants were despatched to Atlanta on February 25th.

W. J. B.

Echium Decaisnei and **E. giganteum**.—Dr. G. V. Perez, Santa Ursula, Tenerife, sends us the following notes on these two species:—"I have in my garden a solitary plant of *Echium Decaisnei* from Grand Canary, which is remarkable for its resistance to drought and the very long time it remains in flower. At a distance it is not at all unlike *Echium giganteum*, a native of Tenerife, but its leaves are much more prickly, and its flowers of course are quite different and tinged with a pretty blue.

"The curious thing about this plant is that I have not as yet succeeded in reproducing it true from seed; so far as I know, all the seed I have sown and the numerous seedlings I have collected at its base have turned out to be hybrids. In this respect this solitary *Echium* reminds me forcibly of my experience with single plants of our various species of *Statice*, which practically never come true, but always as hybrids. I have just now three young plants raised from *Echium Decaisnei*, and extremely like it, but on close inspection I have little doubt that they are hybrids of this species and *E. giganteum*. These hybrids show the great similarity there is between these two species, and they might well be taken on superficial examination for either of them. As both of them flower immediately after the first rains, they and their hybrids would be very suitable for certain parts of India, Egypt, Syria, etc. Many of our species of *Echium* are late flowerers, but these are usually out at Christmas. Another very early and pretty flowered *Echium* is *E. nerrosium*, from Madeira; it is very beautiful just now (January 21st), and ought to be hybridised with the former two."

From what Dr. Perez says above it is apparent that these particular *Echiums* are not capable of self-fertilisation when grown as single isolated plants. *E. giganteum* occurs wild in a small tract of country around Dr. Perez's home (Santa Ursula) near the coast on the N.W. of Tenerife (see *Kew Bull.* 1914, pp. 118), whilst *E. Decaisnei* is confined to the island of Grand Canary. Dr. Perez speaks of the superficial resemblance of the two species; they are easily distinguished botanically, *E. giganteum* with fairly broad leaves with minute soft appressed indumentum, sometimes with a few short and slender bristles only on the margin (see *Kew Bull.* l.c. fig. 1 d), and *E. Decaisnei* with narrower leaves, fairly densely sprinkled with broad-based prickles without the appressed indumentum. A short account of the grouping of Canary Island and Madeira species of *Echium* appeared in the *Kew Bull.* 1914, pp. 265-7.

The Botanic Garden, Havana.—A Botanic Garden was founded at Havana on May 30th, 1817, under the auspices of the "Sociedad Patriótica de Amigos del Pais," and an interesting account of the present garden, which is now attached to the Institute of Secondary Education, has recently been published by Dr. Felipe Garcia Cañizares.* The volume is well illustrated with views and plans of the garden, and contains numerous plates and figures of the more interesting plants that are in cultivation. A general catalogue of the indigenous and exotic plants grown forms a valuable portion of the work as the native names of the plants are given with their scientific names, and the whole catalogue is arranged under the natural families. A special account, with figures, is given of the Ocuje (*Calophyllum Calaba*, Jacquin) and there is a complete alphabetical index.

From the historical account of the garden, which occupies the opening pages, we learn that the suggestion of establishing a Botanic Garden at Havana was first made in 1793 by Nicolás Calvo and Mariano Espinosa, but despite the efforts of these originators of the scheme, and the interest displayed by Martin Sesé, the project was not fulfilled until the year 1817, when the garden was commenced on land granted by Sr. Alejandro Ramirez.

The first Director of the Garden was Sr. José Antonio de la Ossa, the author of the "Flora havanensis."

In the year 1824 the Chair of Botany was established, and Sr. Ramón de la Sagra was appointed the first Professor, and in 1827 became exclusive Director of the Garden. He enlarged the garden considerably and also did much for the encouragement of Cuban agriculture.

The garden at a later date was united with the Institución Agrónoma in the Escuela Botánica Agrícola, and was finally placed under the Real Hacienda as a State Institute.

The third Director was Dr. Pedro Alejandro Auber, the distinguished naturalist. From 1864-1897, the second epoch

* El Jardín Botánico del Instituto de Segunda Enseñanza de la Habana, por Felipe Garcia Cañizares, 1918.

in the history of the garden, there is little to record, as its scientific and administrative work was sadly neglected, except that in the year 1866 the garden became a dependency of the University. In 1897 the Director of the Institute of Secondary Education obtained a portion of the garden for his School, and it is with this part of the original garden that the present account is concerned. The garden has been restored to its proper functions under the direction of Dr. Fernando Reynoso, and to his enthusiasm and energy the present prosperous condition of the Havana Garden of the Institute of Secondary Education appears largely to be due.

British Guiana Plants.—Mr. L. S. Hohenherk, Forestry Officer of British Guiana, has published a paper under the title of "Botanical Identifications of British Guiana Trees and Plants,"* which should be useful for the reason that in numerous instances the vernacular as well as the botanical names are given. Specimens of the plants, mostly arborescent, which are enumerated in the list, were brought to Kew by Mr. C. Wilgress Anderson, I.S.O., the late Forestry Officer, and as far as possible they were identified in the Herbarium. The list is arranged in five columns in which are given numbers, vernacular names, localities, descriptive remarks and botanical names. Unfortunately many errors have crept into it, especially in the spelling of the botanical names, and some confusion must have occurred with regard to *Sagittaria lancifolia*, which, we are informed, is a nameless shrub, that it was collected on a sand beach, and that it has latex. S. A. S.

Forestry in the Uganda Protectorate.—Before the year 1917-18 the interests of Forestry, Botany, and other scientific subjects in the Uganda Protectorate were included in one department, but at the beginning of that financial year a separate Forestry Department was created, with Mr. R. Fyfe as Chief Forest Officer, who now issues the first annual report (Annual Report on the Forestry Department for the Year ended 31st March, 1918). The work of the year has been largely of a preparatory nature, including surveys, the construction of roads, the erection of houses, sheds, and a saw mill, and other work necessary to facilitate future operations. Time was, however, found to clear 170 acres of ground in the Busoga Railway Fuel Reserve, and to plant it with 820,000 young trees; to start an arboretum and nursery; to collect and distribute 697 lbs. of tree seeds; to advance work connected with a forest herbarium and museum and to collect 500 lbs. of rubber, valued at £66 13s. 4d., in the Budongo Forest. The rubber resources of this forest are to be developed, but much of the work during the past year had of necessity to take the form of road construction and housing accommodation.

* Journal of the Board of Agriculture of British Guiana, vol. xi, pp. 98-106, 178-185 (1918).

for the forest official and collectors, with sheds and other offices for the reception of the latex and the preparation of the dried rubber. It was also necessary to clear 10 acres of ground for the production of food stuffs for the workers. *Markhamia* (*Dolichandrone*) *platycalyx*, is one of the best timbers of the region, and 810,000 trees of that species were planted in the Busoga Forest Fuel Reserve to 10,000 specimens of other species. Other important trees are: *Balsamocitrus Dawei*, *Cynometra Alexandri*, *Entandrophragma angolense*, *E. utile*, *Khaya anthotheca*, *Lovoa budongensis*, *Podocarpus gracilior*, *P. milanjanus* var. *arborescens*. Of introduced trees, Teak (*Tectona grandis*) appears to be growing freely, and in some places *Eucalyptus* spp. are making rapid growth.

W. D.

Coprosma.—The genus *Coprosma*, first instituted by Forster in 1776; hitherto regarded as of little or no economic importance, has recently been found to possess some interest for the production of dyes from the bark. Out of about 60 species which the genus comprises, approximately half indigenous to New Zealand, the following six have been specially tested by the Department of Agriculture, New Zealand, for their dyeing capacity.—*C. grandifolia*, Hook. f., *C. lucida*, Forst., *C. Baueri*, Endl., *C. robusta*, Raoul, *C. areolata*, Cheesem., and *C. foetidissima*, Forst. These were selected because of their abundance; other species expected to be of interest were not desirable because of their rarity or small size. The first two species mentioned are stated to “fall into a class apart in giving purplish or maroon fast dyes on chrome mordants with wool and orange-scarlet (tangerine) to dark-red shades with stannous mordants and tartar in the single bath method.” Of the remainder it is said: “Two very common species in Wellington, *C. Baueri* (the taupata) and *C. robusta*, have given quite negative results in dyeing tests. *Coprosma lucida*, which also has bark and wood of a yellow colour, gives good reddish-brown colours, which are fast to light and soap, to chrome and alumina mordants. *Coprosma foetidissima* (the hupiro of the Maori and the “stinkwood” of the settler), which has a light green bark, has proved a disappointment, for although giving excellent brown and yellow colours to chrome and stannous mordants respectively and fast to soap, they are not fast to light. This is more to be regretted as the plant has strong tinctorial properties and is very abundant in some districts.”

For fuller information on the experiments, reference should be made to the paper from which these notes are taken.—“The Genus *Coprosma* as a Source of Dyes,” by B. C. Aston, F.I.C., in the New Zealand Journal of Science and Technology, vol. i., No. 5, 1918, pp. 264-267.

Brimstone Tree of Sierra Leone.—In the *Kew Bulletin* for 1916, pp. 8-16, figs 1-4, the writer gave an account of the “Brimstone Bushes” of Tropical West Africa, which name is applied to certain species of *Morinda* (*Rubiaceae*). According

to Mr. C. E. Lane-Poole, at that time Conservator of Forests in Sierra Leone, there is another plant, belonging to a different genus of the same family, which is called the "Brimstone Tree." This is *Mitragyne stipulosa*, O. Ktze. (*Mitragyne macrophylla*, Hiern). Mr. Lane-Poole supplied the following information:—

"The Brimstone tree: A very large forest tree, without buttress roots, growing to a height of 150 ft., and a diameter of over 6 ft. at the base. The bole is straight and generally 40 to 50 ft. to the first branch. The bark is grey, rough, and stringy. It yields a very durable, useful timber; floors built of this may be seen in Freetown up to 100 years old. Practically all the weather-boarding of the wooden Creole houses of Freetown consists of Brimstone. It is of a yellow colour when freshly sawn, but turns much browner with age. The natives in the Protectorate use it for every purpose where sound, durable wood is required. It is not attacked by termites, longicorns, scolytides, or other borers. Young saplings are preferred to any other for rafters in native thatched houses. The ridge pole is generally made of one sapling of this species. The canoe-shaped receptacle used for standing palm-oil in, the wooden platters, the rice mortars, and a number of similar articles, are made of this wood. A decoction of the bark is used to cure malaria, and natives, footsore by long marching, bathe their feet in water in which the bark has been boiled. Mendi name: *Bundui*. Creole name: Brimstone tree. It flowers at the end of April and beginning of May for a few days only."

Mitragyne stipulosa was first described as *Nauclea stipulosa* by De Candolle (Prodr. iv. 346) in 1830, from specimens collected by Leprieur on the banks of the Gambia River. The species is now known to occur in nearly the whole of the forest area of Tropical Africa, from Gambia to Angola (*Welwitsch*), through the Shari region to the Bahr el Ghazal and Uganda, southwards to the Zambesi (*Kirk*). In regard to Mr. Lane-Poole's statement on the use of this plant in Sierra Leone as a remedy for malaria, it is interesting to find a note to the same effect by Kirk, who collected a specimen near Sena, on the Zambesi, in December, 1860.

Accompanying another gathering by Mr. Lane-Poole (No. 214) in Sierra Leone, is a note saying that the leaves of this tree are the only ones used to wrap up Kola nuts, and the same use for them is noted by Mr. Scott-Elliot (No. 5014). According to Mr. H. J. Sankey, Conservator of Forests, Southern Nigeria, the tree is "common along river banks and in swamps in Ordo forests; used for canoes, but not durable; an easily worked, fine-grained, light-brown wood which floats." For further information regarding this tree, see *Kew Bulletin*, Add. Ser. ix. p. 345 (*M. macrophylla*).

J. H.